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ABSTRACT

Offices are places in which information is generated and processed. According to the classic theories of labor organization, human activities can be roughly divided into two main families: manual and intellectual. Each family can be broken down into three basic stages: planning, performance, and supervision. The families and basic stages can be interlinked to obtain a framework of the overall content of work. An analysis of the division of labor based on the main families of work and basic stages provides six primary families of workers: manual work planners, intellectual work planners, manual work performers, intellectual work performers, manual work supervisors, and intellectual work supervisors. The basic feature of factory work seems to be its two-dimensional nature--reasoning and acting. Although the introduction of new technology modifies the structure of job skill needs, the way in which it is linked to labor organization choices determines the job skill content. The emerging overall skills needs are of two main types: specialist and integrator. The new conception of work as a permanent creative process has implications for job skills, industrial relations, and training. A set of training archetypes has been developed that can be divided into traditional and specialist archetypes and highly innovative archetypes. Areas surveyed include office work, financial services, agriculture, and environment. (Detailed specifications of six archetypes are appended.) (YLB)

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Description of a framework of macroprofiles (archetypes)

European Centre for the Development of Vocational Training

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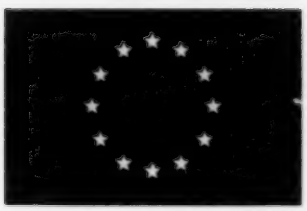

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Description of a framework of macroprofiles (archetypes)

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PREFACE

In 1989 CEDEFOP was requested by the Commission of the European Communities to test the design features and viability of a descriptive model to compare contemporary skill needs in certain occupational fields across the twelve labour markets of the Community, describing them in terms of common and specific features to help define vocational training curricula and at the same time help match the knowledge and skills sought by employers with those offered by workers as their occupational qualifications.

Through this work and in conjunction with that being carried out to establish comparability of vocational training qualifications at skilled worker level, the Commission is seeking to improve the transparency of occupational profiles and qualifications with a view to facilitating the free movement of manpower within the Single Market.

Throughout 1990 the Centre worked on developing this model to compare occupational profiles in a number of occupational fields in some Member States. The model includes a prospective element insofar as it is also designed to take account of the changes taking place in these profiles as a result of new work processes and corporate restructuring in preparation for competing on international markets.

As a Community organization, one of the Centre's tasks is to prepare the ground for decision-makers in the Member States and at the Commission by providing information on the avenues open for investigation in this field, one which is so important for vocational training at this time; in other words to provide back-up for those who are researching in depth the development of professional competence.

Accordingly, the Centre commissioned the work which is presented in this CEDEFOP Document. A study which serves as a backdrop for others addressing occupational profiles which reflect still very different realities. A study which focusses on occupational fields as sensitive to technical and functional changes as mechanical engineering and administrative and management service operations: concrete, tangible fields of activity and occupations which, for this reason, are calling for skill profiles with a strong capability for responding to changes within companies and on transnational markets.

Despite its more radical outlook, this study links up with a hypothesis which underlies the methodology used by CEDEFOP to compare occupational profiles in twelve Member

States, namely to avoid addressing "terminal" profiles, not only because this would virtually defeat the objective of the exercise but also and mainly because, given the realities of the Community today, vocational training has to pursue approaches which facilitate workforce mobility and respond to the increasing flexibility required of an occupational profile in any particular company or other productive unit.

In an attempt to draw up directories of occupational profiles which extend beyond sectors of economic activity and occupational nomenclatures which are specifically national, the approach used, based on typical fields of occupational activity, proceeds in acknowledgement of the following phenomena:

- globalization of economic policy with convergence (or divergence) between social systems and development zones at the supranational level;
- rapid spread of information technologies and industrial automation which is also strengthening the trend towards an internationalization of work processes;
- more urban lifestyles with the development of the services sector of the economy and diversification of its product range;
- as a result of these phenomena, the spread of interlinked transversal technologies throughout entire national production structures - and to an increasing extent those of the Single Market - (a clear example here being microelectronic technology), with very varied mechanisms for exchanging information and with the resulting need for flexibility in education and vocational training systems.

The vocational qualifications produced should be seen as an integration, at curriculum level, of traditional skills and abilities with increasing importance being attached to information technologies and with a stronger role for communication and learning skills.

One clear conclusion is the major role and growing importance of vocational training as a continuous, on-going process where the boundaries between initial and continuing training are probably crumbling to become nothing more than administrative and economic interfaces; this for the simple reason that, with information taking over from raw materials and machinery as the new reference framework, professional competence will require greater capacities for correction, adjustment and "creative" interventions in the work process.

In the light of these considerations it is interesting to see that post-industrial occupational competence has much in common with the alternative of regarding an occupation as a set of "functions", where being capable of observing, interpreting, inferring and making decisions become the core elements of professional aptitude.

The preceding comments can be summarized as follows, in the view of the authors: the changes taking place in the outlines of occupational profiles in demand today are of such great magnitude that the traditional frontiers between the shop floor and the office are becoming blurred. This conclusion is of eminent interest for those who design and plan vocational training - the readership to whom this study is primarily addressed - but also for those who bear responsibility for decision-making on matters of educational reform and human resource development policy.

CEDEFOP is pleased to be able to offer this research document to the staff of the relevant departments of the Commission and to other readers of the Centre's publications. At the same time it extends its thanks to the authors, Dr. Parracone, Dr. Schiavone, and Dr. Uberto, and to the SPIN institute for undertaking the difficult task of drawing up a synthesis of such broad-based empirical research.

Berlin, December 1990

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INTRODUCTION

The starting point for this research report is the following consideration:

"While the comparability of occupational profiles seems set to become a problem which is impossible to solve in the formal representations of the various Member States, views on the state of the art, the content and the potential development of occupational skills are surprisingly comparable at an informal level (as regards the top technical and practical skill levels)".

This contrast between "formal differences" and "actual consensus" is obviously not just the result of language differences. Two factors need to be examined:

- the definition of an occupational profile, in terms of the education system, social recognition, industrial relations, etc., is strongly linked to local cultural and economic contexts;
- while the development dynamics of occupational skills are at present tending, on the one hand, to standardize the principal skills, they are also tending to some extent towards a wide-ranging differentiation of the end skills, i.e. those skills that training systems are endeavouring to ratify.

In these circumstances, any attempt to work out a comparability table is unlikely to be very successful unless there is a realistic approach to the problem of:

comparability limits, as regards:
- time scales;
- the main area in which the comparison table is to be used (training system? industrial relations? etc.).

This report, which takes a medium-term time scale and the training system as the main area of use, bases these comparability limits on two hypotheses:

1. that **occupational needs**, rather than legally defined occupational profiles, provide a very effective way of locating a lowest common denominator for the formulation of a comparison table;
2. that a realistic comparability limit can be found by identifying overall occupational archetypes from which end skills radiate out.

Although this may be no more than the first step, the authors feel that it is a crucial step paving the way for realistic comparison and harmonization of the different European professional systems.

Taking real needs and archetypes as a basis introduces considerable simplification, but also points to surprisingly convergent and clear maps of skills.

In substance this involves exploiting, rather than a Europe of twelve different professional languages, the **real convergences of training needs** in a working Europe in which the need for specialists, multi-skilled operators and new integrator profiles is emerging everywhere and which must meet the challenge of total quality, on-going improvement and new forms of production organization which are all playing a crucial part in competitiveness.

In other words it is an attempt to find solutions to the problem by looking at the Europe of the present and near future rather than looking for complex links in the Europe of the past.

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CHAPTER 1

THE DIMENSIONS OF OFFICE WORK

1.1 The office galaxy: is there a common denominator for analysis?

There is an obvious difference between offices and factories. Factories, following the technological innovation and restructuring of the 1980s, seem to have become much more efficient than offices. Is this no more than a time lag or are different outcomes involved?

In our society office work has been and is still viewed by many people in a contradictory way: millions of young people (and their families) hope that they will find an office "job" when they leave school because offices are safe, offices are peaceful. On the other hand, our culture and especially the culture of the young has a very negative stereotype of the office as a place of monotonous, inefficient and bureaucratic (in the pejorative sense of the word) work.

When people talk about this stereotype they forget that top managers, successful entrepreneurs and managing directors also work in offices and forget the growing role which office work is playing, for instance, in industrial production: office workers do not just read, write, transcribe and prepare documents, they evaluate investment plans, design, plan and develop products, spend money and administer.

Many people have yet to grasp the increased strategic importance of office work as a focus for the generation

and processing of information on which decisions relating to the activities of any type of organization can be based.

Office work consequently tends in practice to be more varied and complex than the processing work of a factory, even though automation and technological innovation are bringing these two workplaces closer together (1).

The generation and processing of information are two separate stages which give rise to different types of office work.

If we are to elucidate these types of work we need, in

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(1) Overall, the minor changes which office automation has brought about in the way in which offices are organized are not at all comparable to the changes brought about by factory automation. This is true in Italy and Europe as a whole, but is slightly less so in the USA and Japan, even though the "Japan 1990s" Committee, set up in a somewhat remote 1983, predicted that office automation would develop comparatively spontaneously almost to the end of the 1980s and would do little more than replace low-level secretarial work. The Committee felt that re-organization similar to that caused by robotics in factories would only start towards 1988/89. Even though office automation is still being used largely to simplify repetitive activities and make them more reliable, there is little doubt that we are on the verge of very exciting changes since, as has already been the case with manual workers, they will entail professional growth and human satisfaction in the white-collar technical and managerial grades which are traditionally less vociferous and more united, but also better educated and more cultured.

the first instance, to define the meaning of the term "information".

The definition which we have used in this report is as follows: ***information is a message exchanged between two people - an "issuer" and a "receiver" - which is transmitted using suitable signals and methods.***

Perhaps we can illustrate this in practice: A asks B to work out the profitability of an investment x and instructs him to consult pamphlet y for this purpose. There are consequently two basic types of information:

- *between A and B the information is an* ***instruction;***
- *pamphlet y provides* ***procedural information.***

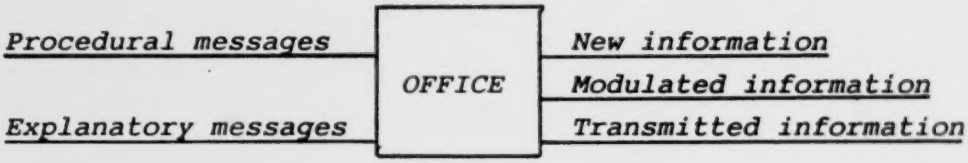
These two initial types of information generate others which lead subsequently to information in the form of an ***overall evaluation*** *of the profitability of the investment in question to be passed back to A and ultimately used by the company management as a starting point for decisions relating to the operation's feasibility.*

This consequently provides a circular route made up of ***"recurrent transactions"*** *whose basic components are:*

- *instruction;*
- *performance;*
- *control.*

These are the three "key areas" which affect one another reciprocally at the various levels of the organization as Fig. 1 shows:

Fig. 1:



*Incoming **explanatory** messages (orders, requests) and **procedural messages** (instructions) are converted into new **information, modulated information** and **transmitted information**.*

The outgoing signals may in turn be explanatory or procedural signals intended for other offices which set in motion the chain of recurrent transactions. The diagram is obviously equally valid for other types of activity since it is not the message categories which change but the content of the messages.

*Taking this as our starting point, we have chosen to base our analysis on the **category of messages** since this is the only common denominator making it possible to deal in a comparable way with a universe which is as variegated and dissimilar as that of the office.*

Looking at this in further detail, the following definitions are possible:

*a. The **explanatory message** takes the form of an order, passes on an arrangement, activates a process and*

emanates from the organizational hierarchy.

b. *The* ***procedural message*** *contains instructions on how to perform the content of the explanatory message. Its basic characteristic is that it is part of the "organization's expertise" and is directly linked to man's creative activity and the organization's conventions.*

c. *The* ***new information*** *consequently does not exist independently but is generated by a creative process activated by messages A and B and forms the core or central nucleus of office work.*

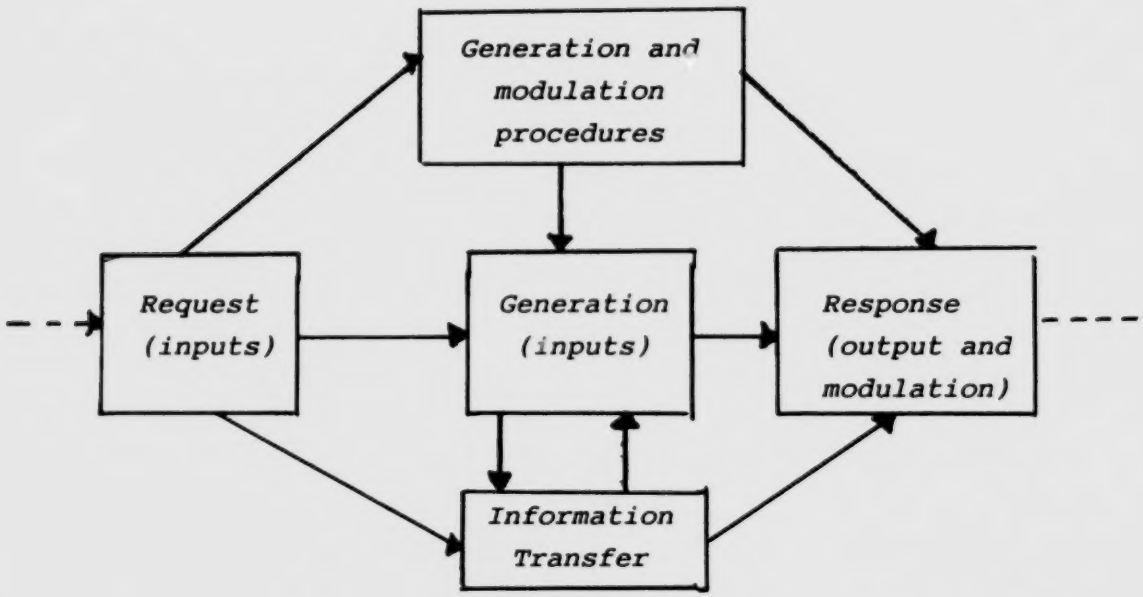
d. *The* ***modulated information*** *(or overall evaluation) can be formulated only after point c has taken place and is formalized through the procedures set out in point b.*

e. *The* ***information transmitted*** *entails only a process of location and selective distribution and is therefore linked to the organizational hierarchy and to information systems.*

*At this point the particular structure of the office (see Fig. 2) appears as a "**node**" of a complex and many-faceted information network within which* ***intangible value is***

added to information (2) unlike a factory where objects are processed.

Fig. 2



It needs to be stressed, however, that every office has its fair share of pure and simple information transfer and sorting, although the extent may differ, which can be defined as routine work or bureaucratic activity; this

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(2) It should be borne in mind that the term "information" does not necessarily signify "news" but some input or output of an intangible type which is entering or leaving the office.

type of information produces an "added value" which is, however, much less than that involved in the stages of generating and processing responses.

1.2 Creative, interpretative and decision-making activities

If we are to identify possible links with automation and comprehend the changes which have taken place in office work as a result of the spread of innovation into environments outside the office itself (3) it is necessary to look at "creative", "interpretative" and

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(3) It is dangerous to equate changes in office work with changes brought about by the introduction of new technology into the office. Word processors, electronic data storage and computer graphics are not the main factors in these changes: much more important changes have been brought about by the introduction of innovative technology into firms as a whole (production, logistics, distribution) and into the major infrastructure within and outside firms.
In very brief terms, changes in office work are due to:
a. external factors (relating to the type of requests forwarded to offices and the type of reply which is expected);
b. internal factors (relating to the methods which offices use to generate information, organize it into replies which can be passed on and then sort it externally).
Up to now, despite advances in office automation, the changes which work has undergone can be attributed largely to external factors. This is probably due to the fact that no satisfactory way of using innovative technology effectively in creative, interpretative and decision-making processes has yet been discovered.

"decision-making" activities.

***The creative process** is a complex event which can be broken down into at least three stages which are conceptually separate:*

a. *the imaginative stage in which a new principle, basic idea or concept is discovered;*
b. *the stage of discovering possible links between new concepts or between existing concepts;*
c. *the stage of combining concepts into complex systems through which new results can be achieved.*

The creative skills needed in the three stages listed above are not the same and have different connotations. The stage described in letter a. can thus be defined as "basic creativity" and the creative stages of letters b. and c. as "systemic creativity".

These three key areas of creativity are an indispensable starting point for formulating a method of interpreting innovative activity as a whole in the various areas of work ranging from design work to routine or executive work.

***Interpretative and decision-making processes** require mental processes allowing the selection of one of many possible paths.*

If we are to illustrate the interpretative process we

need to look in some detail at the nature of "formal" and "informal" systems.

Repairing a machine, writing a letter, drawing a design, approving a venture are all examples of activities intended to modify a particular situation, moving from an initial state A to a factual state B: the set of rules making it possible to achieve the A-B transformation gives rise to a "procedure" which is broken down into a sequence of steps known as a "string" in technical terms. The system is formal when these procedures are completely circumscribed and can be defined by fixed rules; the procedure is "linear" if the sequence of steps (or strings) is direct; the procedure is "branched" when alternative solutions are possible for each string.

Work which is governed by formal linear procedures is not normally concerned with creativity, decision-making and interpretation: it can be performed simply by following the procedures (4).

While informal systems do not follow the same pattern, formal systems may also contain steps which have not been formalized which are always subject to the rule that when

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(4) Many activities considered to be complex are in practice simple and of a mechanical nature, while others which are considered to be routine may provide considerable scope for creativity, interpretation and decision-making.

there are no specific procedures entailing mechanical action, workers have to operate in an interpretative dimension.

In other words, when there are no fixed rules and when faced with random events, workers move into the realms of creativity, inventing the criteria needed to resolve the problem.

Interpretation consequently consists in:

a. knowing how to make the most of unforeseen situations;
b. making sense of "ambiguous" messages;
c. assessing the relative importance of the various factors involved in a situation;
d. finding "similarities" between different situations and "differences" between similar situations.

While contradictory messages are seldom encountered in an organization there may be ambiguous messages which have to be interpreted. This activity becomes more difficult and complex when a procedural mechanism has to be interpreted as a whole: this is true, for instance, of recurrences (i.e. monitoring the same event which is uniformly reproduced at different levels): discovering the "recurrent" nature entails locating the functional comparability of the various procedures and activating the interaction between man and system (see Fig. 3).

The ability to interpret this type of interaction - and its relative messages - is an important component of

modern occupational skills since it means that the action can be made effective in any situation and speeded up appropriately: in a formal system the time needed to resolve problems is fundamental and is often a criterion in choosing one decision over another.

By way of conclusion, it can be said that interpretative complexity:

a. does not exist in practice in linear unbranched procedures;

b. increases in relation to:

- *extent of branching,*
- *extent of interaction with external factors,*
- *number of codified factors,*
- *extent of "recurrence".*

The "decision-making" factor follows the same pattern as the interpretative function with the addition of the "minimum time" and maximum convenience criterion.

In other words, after a number of possible ways of solving a problem have been pinpointed by interpretation, the solution judged to be most convenient and most rapid has to be selected from these alternatives.

The features of a particular type of work derive from the "quantum" of creativity, interpretation and decision-making which this work contains and from the way in which they are interlinked.

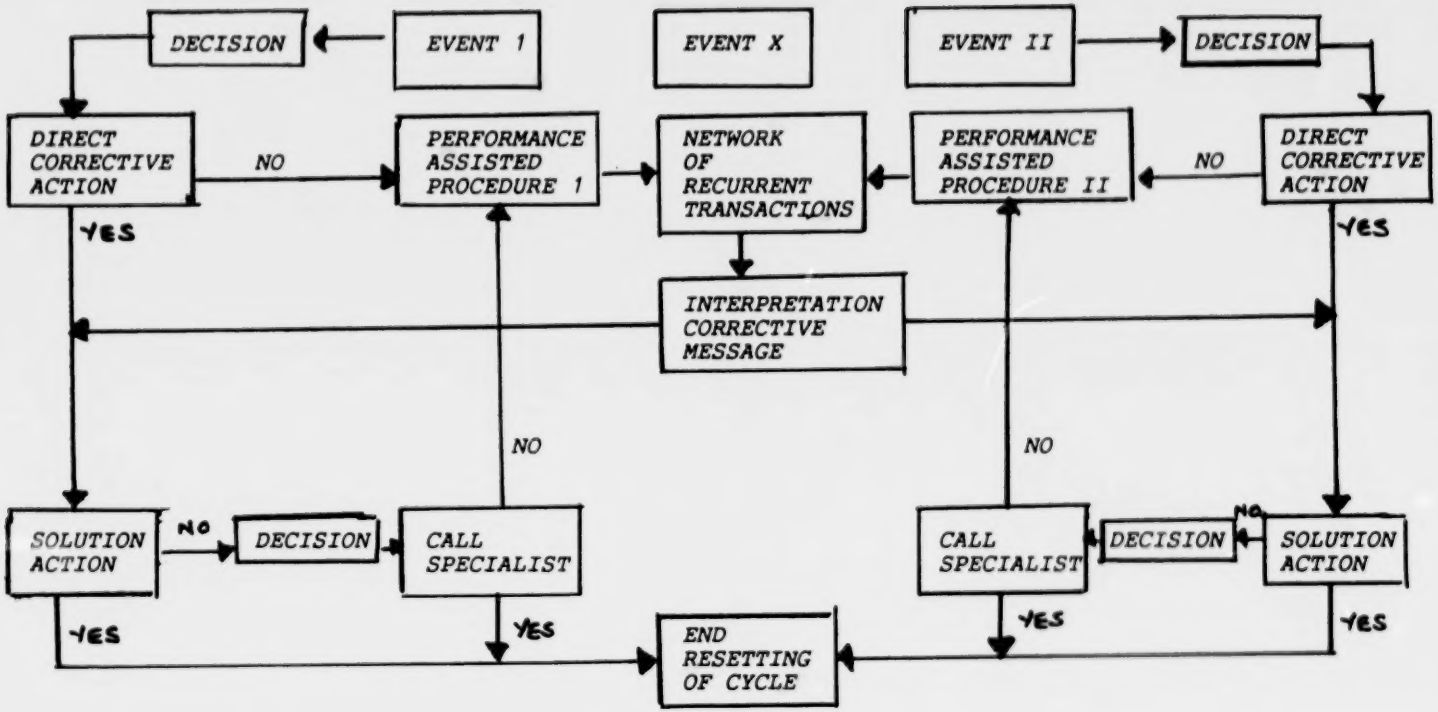

Fig. 3: DIAGRAM OF RECURRENCE

1.3 Degree of informality/discretion and individual contribution

It has to be borne in mind that work almost always takes place in an organized structure which brings other components, depending on the specific type of work, into play. While **creativity** is largely linked to the specific nature of the task, **interpretation and decision-making** depend largely on the "context" in which the work takes place; relations with the surrounding organization raise a new type of problem which is linked to the sphere of control. For instance, drawing as a way of passing one's leisure time is not subject to any constraints and takes place in a completely free context. If drawing takes place within an organization, however, the process is conditioned by operational requirements: the method of performance is usually subject to formal constraints, the time to be taken is usually laid down and so on. As a result of its internal needs, the organization tends for this reason to proceduralize the work which very often has repercussions on its creativity, interpretation and decision-making components.

What has been said above about the two types of procedure needs to be borne in mind here: procedures which are completely formalized do not allow any significant freedoms and procedures which are only scarcely formalized do not entail the total controllability of the former. Up to now, organizations have normally tended to bring all activities within the band of tasks which can

be subject to greater "proceduralization", require less discretion and are more controllable, but emerging requirements are gradually leading to a proportion of activities for which the procedures do not provide or which are difficult to bring within formal methods; this sets in motion a process where proceduralization and creativity are in continual pursuit of one another which plays a fundamental part in the effects of innovation on office work.

A further factor plays a part in defining work: the individual contribution.

We can illustrate this through the schemes discussed above:

1. *The transition between A and B may take place through a **single** sequence of steps, whose length, content and sequence are all known; the procedure is totally formalized and the system is fully controllable.*

2. *The transition between A and B may take place through a **single** sequence of steps, whose length and sequence are known but whose content is not: in this case the transformation can take place in more than one way and the procedure has a degree of informality limited to the inner workings of a predetermined formal scheme; controllability is consequently limited to checking consistency with the formal scheme.*

3. *The transition A-B may take place through a* ***multiple*** *sequence of steps, whose length, content and sequence are all known; the transformation can thus take place in a single way but only within each individual formal scheme and the control has to take account of the fact that this particular scheme has been chosen from all the possible schemes, while checking, however, for consistency with the maximum convenience criterion.*

4. *The transition A-B may take place in many different ways (where the content and the length of some transitions are not known). Consequently the transformation cannot be proceduralized or, in other words, is completely informal.*

All work activities within the various types of organizations in practice entail a varying mix of situations 1-4 above.

The choice of this mix depends on the "specific individual contribution" provided; this is therefore the final basic attribute characterizing work.

In other words, when formal procedures do not lay down the absolute best path, but each of the alternative paths may become the best in relation to the particular context and the specific circumstances, the worker's specific ability to find the optimum path then comes into play: this ability leads to the "specific contribution" typical of professionals or high-level workers.

In addition to being able to select the most appropriate path, the contributor also has to want to follow this path through his own free volition to keep to the organization's objectives.

1.4 Reference scheme for the interpretation of office work

By way of conclusion to this chapter, it may be useful to summarize the main points which have been made up to now:

- *Offices are places in which information is generated and processed. In greater depth:*
  - *"procedural messages" (i.e. instructions on how to carry out requests) and instruction messages (setting out orders and issuing directions) arrive in the office;*
  - *new information generated as a result of "external stimuli" leaves the office;*
  - *"modulated" information, i.e. overall responses which combine the new information generated to provide an overall result, leaves the office;*
  - *finally "transmitted" information, i.e. existing information which the office has selected and sifted, leaves the office.*

Three basic stages shape this information activity as a whole:

a. the creative stage during which new basic ideas are

developed or - much more often - where new values are found for existing concepts or new ways are found for putting these concepts together;

b. *the interpretative stage during which explicit meanings are given to ambivalent or ambiguous messages;*

c. *the decision-making stage during which one of the many possible paths is chosen on the basis of the criterion of relative convenience.*

Each of these stages involves varying levels of creativity and discretion: conduct is not based on rigidly defined rules but brings into play the potential for choice paving the way for the specific individual contribution which is linked to the worker's free and voluntary support for the organization's goals.

CHAPTER II

DIVISION OF LABOUR AND CLASSIFICATION

2.1 Division of labour

According to the classic theories of labour organization, human activities can be roughly divided into two main families: manual activities and intellectual activities. Each of these families can then be broken down into three basic areas, as mentioned above: prescription, performance and supervision.

Prescription corresponds overall to the stage of planning: the information generated in any plan becomes "prescriptive" for the person who has to carry out the subsequent stage of performance and then acts as a reference for the subsequent stage in which the work performed and the plan are compared, i.e. the supervisory stage.

The two families (manual work and intellectual work) and the basic stages (planning, performance and supervision) can then be interlinked to obtain a "grid" of the overall content of work as shown in Table 1.

The division of labour is carried out by an organization when it assigns specific work contents to individuals who take responsibility therefor. This is no easy task since the division of labour does not take place solely on the basis of criteria of discretionary choice but is influenced by expediency and the different matrices (especially the technical and technological) which have been chosen.

An analysis of the division of labour based on the main families of work and the basic stages as described above provides six primary families of workers, i.e.:

- *manual work planners,*
- *intellectual work planners,*
- *manual work performers,*
- *intellectual work performers,*
- *manual work supervisors,*
- *intellectual work supervisors.*

In practice it is impossible to describe work in such a simple and linear way since the two activities - manual and intellectual - are never completely separate and neither are the different stages of planning, performance and supervision. New technology is tending in contrast to interlink the various components of Table 1 to an ever greater extent so that the division between manual and intellectual work is gradually becoming outdated and the lines of demarcation between the different stages are becoming less clear-cut.

Table 1: ***CONTENT OF WORK***

Families / *Stages*	*MANUAL*	*INTELLECTUAL*
PLANNING	*Identifying content, people, methods, timescales, resources goals and instructions*	*Identifying new ventures, formulating new organizational expertise, identifying new conceptual systems*
PERFORMANCE	*Implementing all the planning prescriptions incorporating any deviations from plans*	*Developing ventures by generating the inputs needed, interpreting and deciding on alternatives*
SUPERVISION	*Checking results are in line with plans in respect of all the variables laid down: time, methods, people, etc*	*Interpreting the effectiveness of the results achieved with respect to the objectives laid down*

In other words, new technology, viewed as a trend, expresses the movement towards increasing integration.

The components of the grid of Table 1 can be combined in a variety of ways providing a number of "sub-sets", each of which combines the attributes of creativity, interpretation, decision-making, discretion and specific contribution in a different way and from which the effects of the impact of technological innovation can be analysed.

There is, however, an infinite number of permutations: in order to make the sub-divisions as simple and clear as possible, the concept of predominance has been introduced.

In Italy, for instance, the law provides for:

- *manual workers, i.e. those who undertake activities which are "predominantly" manual;*
- *clerical workers, i.e. those who undertake activities which are "predominantly" intellectual;*
- *managers, i.e. those who undertake activities "predominantly" involving control, supervision and decision-making.*

This division into categories, although useful from the legal point of view, is outdated and is the more outdated the more sophisticated the technological environment in which the work takes place.

In particular, types of work consisting of a mixture of manual and intellectual activities to which it is somewhat difficult to apply the criterion of "predominance" are spreading very rapidly (and will probably predominate in the not too distant future); it seems appropriate to classify all these trades and professions in a new primary family known simply as technicians.

In other words, the division of labour, understood as a division between manual and intellectual activities is an archetype which is on its way towards permanent and total eclipse; it also seems true to say that the more complex the technological context surrounding work which is defined as manual, the higher its content of intellectual work.

Although the manual-intellectual division is tending to become less clear-cut it still has some validity as regards the mix of the three stages of planning, performance and supervision.

Table 2: ***PREDOMINANT ACTIVITIES AND MIX OF STAGES***

Sectors / Stages	Manufacturing	Services
PLANNING	*Clerical workers* *Managers*	*Clerical workers* *Technicians* *Managers*
PERFORMANCE	*Manual workers* *Technicians*	*Manual workers* *Clerical workers* *Technicians*
SUPERVISION	*Clerical workers* *Managers*	*Clerical workers* *Managers*

For instance, the mix of basic work attributes (creativity, interpretation, etc.) in the "performance" work of a manual worker differs from the mix in the "planning" work of a clerical worker. Even in the latter case the situation may vary greatly: "inventing" the combustion engine requires a much greater creative input than the improvement of an engine, however sophisticated, for a Formula One car.

Maximum creative potential comes during the stage of "designing" something, whether it be a work of art or a consumer product.

At the performance stage, creativity takes the form of finding new values for or implications of existing concepts; this is the type of creativity which we have defined as "systemic".

At the third stage of supervision, the creative component of work is further curtailed. Once the model to be followed has been defined, supervision merely entails mechanistic repetition and accuracy, i.e. the exact opposite of creativity, whereas it may involve high levels of interpretation and decision-making (5).

It is possible, moreover, to define the stage of interpretation, which consists in practice in giving a concrete and congruous meaning to ambiguous (and in some cases contradictory) messages, in more specific terms as "reading weak signals"; workers may come up against situations and aspects whose contours are blurred making it difficult for them to assess and measure the quality and extent of their action.

The only solution in this case is to look at the weak signals which the system is giving off and, via the creative process, add whatever is missing so that the necessary decisions can be taken.

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(5) It should be noted, however, that the design of a control system is creative work rather than supervisory work.

Interpretation and creativity are therefore connected, albeit separate, variables. We can shed further light on this by saying that creativity is a "genus" of which systemic creativity is a "species" while interpretation is in turn one of the various sub-species of systemic creativity.

In other words, interpretation is a process which completes, via creative activity of a systemic type, the content of an incompletely formulated message; it takes place at all levels and in the various contexts involving systemic creative activity.

As we have seen, decision-making is an aspect of work which takes place downstream of a creative and interpretative process. Its role and importance become evident when the things to be done and action to be taken have not been specified as there are "residues of uncertainty" in the choice of one of a number of alternatives, thereby bringing intuition, risk and personal assessment into play.

The decision-making mechanism is the same, however, in every context; it is only the effect which the decision has on the result which changes.

2.2 Classification

We shall now look at the impact of the various "stages" and their associated features on the four main families

of working activity.

MANUAL WORKERS

Creativity: the type of work rules out basic creativity; systemic creativity is, however, tending to increase with the spread of new technology.

Interpretation: is part of basic tasks in contexts where there are significant levels of informality and discretion; its scope is limited to aspects of task performance.

Decision-making: is limited to the residual discretionary powers connected with the basic definition of the task.

Specific contribution: optional contributions to improve production or the working environment are possible.

Informality-discretion: tends to be ruled out by the division of labour and the supervision of all the parameters. When new technology is involved, the scope for discretion tends, however, to increase with the sophistication and complexity of the system.

CLERICAL WORKERS

Creativity: both basic and systemic creativity are a necessary part of the task. The mix of the two types of creativity varies greatly depending on the context

surrounding the work.

Interpretation: varies from situation to situation; it also depends on the extent to which the work has been formalized.

Decision-making: is limited to the residual discretionary powers assigned by the division of labour and by the basic definition of the task assigned.

Specific contribution: is the basic feature of clerical work which is aimed, through its very nature, at increased participation and progressive improvement.

Informality: the organization tends to formalize routine work, separating it from creative work and decision-making. Informality is, however, an intrinsic feature of much clerical work.

TECHNICIANS

Creativity: with the exception of researchers, basic creativity is not normally needed. Systemic creativity increases, however, with the complexity of the context surrounding the work.

Interpretation: varies from case to case depending on the extent to which the work has been formalized.

Decision-making: there is full decision-making autonomy

within the limits of the responsibilities assigned.

Informality:

Specific contribution: is generally required as a way of contributing to and participating in improvement.

MANAGERS

Creativity: basic and systemic creativity are both part of managerial tasks, although their scope and importance vary in accordance with the different traditions and predominant values of individual organizations.

Interpretation: is a typical feature of managerial tasks and is linked to the type and level of responsibilities assigned and the decisions which have to be made.

Decision-making: managers have to have maximum autonomy within the area for which they are responsible.

Specific contribution: managers themselves play a central role in promoting specific contributions.

Informality: managerial activities are described in terms of objectives within which managers have to develop creative initiatives. The content of the work cannot therefore be formalized but only the scope of the powers delegated.

CHAPTER III

COMPARISON OF OFFICE AND FACTORY WORK

3.1 The two-dimensional nature of factory work

In previous chapters we have seen that messages of various type come into offices and new information of various types and with various objectives leaves offices; in other words, an added value is given to the "input value" making a new "output value".

In the most basic and conventional office, information takes the form of written documents which are kept in paper files (6).

The factory can also be seen as a centre, a sort of "black box" into which materials and information are fed and from which products and modulated information emerge.

The flow diagrams of the office and factory are therefore comparable.

In an office, however, the main activity is the processing of information and the flow of materials is the carrier of this information.

In a factory the main flow is made up of materials which are progressively converted from raw materials to

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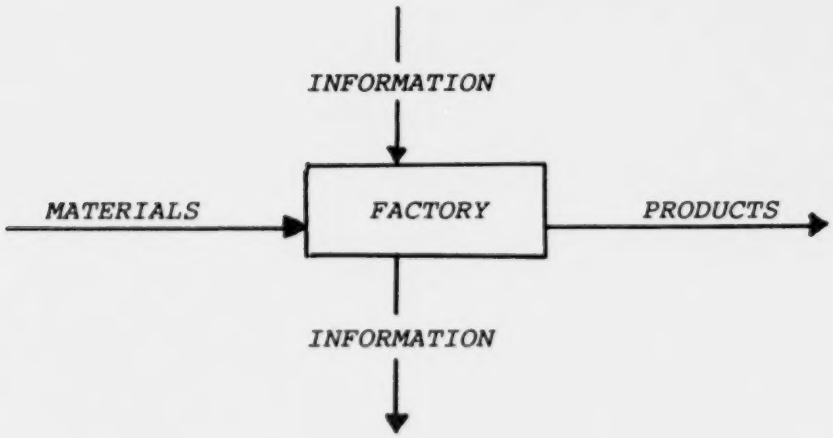
(6) The gradual spread of new message communication means, however, that paper is not the only medium nowadays.

saleable products. There is also a flow of information in the factory, generally of a "transverse" type, which is less apparent and, broadly speaking, less important than the longitudinal flow of materials (see Fig. 4).

Fig. 4



It is likely that the horizontal flow of information comes from the office. This flow contains, as mentioned above, a "procedural" component containing instructions on how to carry out what has been requested and an "explanatory" component in which orders are given and directions issued.

In a factory, however, a procedural message contains information instructing the factory's social and

technical system (7) on the way in which the material in transit is to be physically handled, how it is to be supervised and how its quality and quantity is to be checked.

The procedural message consequently includes components such as:

- *operating schedules which lay down the way in which each stage of machine work is to be prepared;*
- *production cycles which set out the sequence of machine work stages;*
- *working methods showing how the task assigned is to be carried out;*
- *process parameters which establish the values of technical variables;*
- *machine operating programs containing the commands to be input into the "memories" of plant so that the cycles which have been decided can be carried out;*
- *computer-aided operation procedures;*
- *"weak" and "strong" signals relating to product and process quality making it possible to monitor for any deterioration in the quality of these products and the operations carried out on them.*

The explanatory message contains information, directions and orders, such as what to do and when to do it, the

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(7) The "social and technical system" is no more than the men and plant present in an organization, whether a factory or an office.

quantity of materials to be processed, their destination, etc.

The explanatory message consequently has the following components:

- *the quantity of production required per unit of time;*
- *the list of materials forming sub-groups, groups and assemblies;*
- *locations and quantities of materials in the final warehouses;*
- *quantities of semi-finished materials along the lines;*
- *working times;*
- *change-over and production times;*
- *delivery times.*

These examples form only a small part of the enormous flow of information which has to pass through the factory so that the process can take place. They give some idea, however, of the constant overlap between office and factory and are a starting point for understanding the fundamental link between innovation, work and job skill structures.

A question which arises at this point is whether the factory is itself becoming an office since information of varying degrees of complexity is input and further information is output just as in an office. It is useful to look at this particular aspect in more detail.

We have seen that the signals entering a factory may be

procedural (concerning the operation of production machinery and instruments and ending up for the most part in the "memories" of computers controlling flexible processes) or explanatory and aimed at workers' intelligence and memories. The interactions between information flows and physical flows consequently involve the components of choice and decision-making which set the system in motion and keep it going.

In factories of the past the information which was output usually related to checks on the conformity of the processed product with the procedural prescriptions and orders received. The situation is changing rapidly, however, as a result of technological and organizational innovation.

This means that the more artificial intelligence that a production process contains and the more the creative scope assigned to workers, the more the factory becomes a place in which original information which did not exist before can be generated; this bears out what we have said above about the rapprochement of office work and factory work (8). As regards technology, for instance, offices are introducing basic technology, while factories

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(8) It should also be borne in mind that paper does not generally circulate in factories and that new technology is also tending to reduce the flow of paper in offices thereby paving the way for increasingly standard and comparable work in the future.

(computerized and automated) are introducing operating technology, but it is now evident that new information - over and above the specific process of converting materials into products - is being generated in factories as well. The factory seems to be changing into a kind of new office-cum-laboratory where two multi-faceted dimensions are simultaneously present in a balanced way: a material dimension linking up the whole of the traditional manufacturing process and an information dimension within which the permanent creative process can develop.

This situation has never arisen in the past and may pave the way for enormous changes; dynamics unknown until yesterday are emerging between the "material dimension" and the "information dimension".

To sum up, it seems that the basic feature of factory work is starting to be its two-dimensional nature, i.e. the multi-faceted aspect of the dual concept of reasoning and acting.

3.2 The new significance of work

What has been said above can now be transferred to the diagram of Fig. 5 which clearly shows that "the office is a place where information is processed in a creative and repetitive way" while "the factory is a place where materials are processed in a repetitive way and information is processed in a creative way".

This is a new situation entailing a new "office-factory" relationship.

The change underway is so far-reaching that it is causing work to take on a new significance.

We have seen that the factory may itself become a place where information is creatively processed, provided that:

a. *workers are assigned actual responsibility, allowing them to express their own potential intelligence;*
b. *these workers actually want to develop this potential (9).*

If the largest possible number of people are to be encouraged to make a creative contribution, it is necessary to be conscious and convinced that transparent objectives and equal relations are the fundamental starting points for genuine involvement and open and willing participation.

This opens up a basic and important problem for human relations in complex organizations; the training process which will need to be set in motion in the near future -

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(9) Not all workers are interested in more creative work; continual attempts to find improved solutions may lead to fatigue, stress and uneasiness; there are undoubtedly those who prefer the more reassuring status quo.

as well as meeting scientific, technological and organizational changes - must take account of ways of motivating people to become involved and improve themselves constantly so as to provide the maximum potential for creativity within "intelligent" systems.

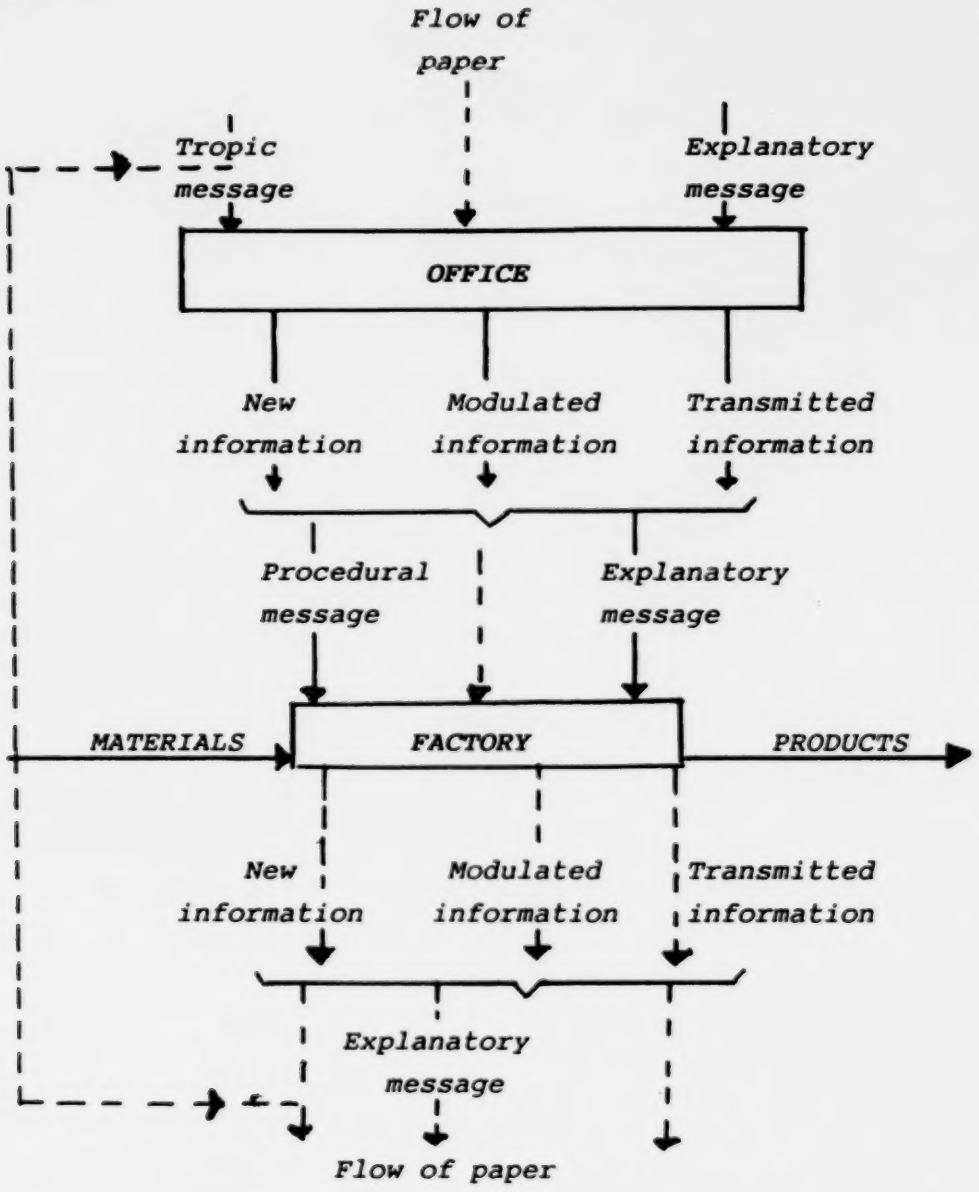
By way of conclusion to this chapter, it seems appropriate to recall the basic features of the interaction between new technology and the content (and significance) of human work in the light of the "reasoning-acting" binomial.

In the final analysis, technology can always be seen as the application of "instruments".

In the office, these instruments are designed to modify or replace the flow of paper, to process and handle information and to act as a back-up for interpretation and creativity in continuous upgrading processes.

In the factory, however, these instruments play their part at the outset in the physical handling of materials and then in management, i.e. supervision and regulation, and finally, through monitoring and expert systems, in horizontal flows of information.

Fig. 5


Flow of paper
Tropic message
Explanatory message
OFFICE
New information
Modulated information
Transmitted information
Procedural message
Explanatory message
MATERIALS
FACTORY
PRODUCTS
New information
Modulated information
Transmitted information
Explanatory message
Flow of paper

CHAPTER IV

DEVELOPMENTS IN OFFICE WORK

4.1 Developments in production processes

Two factors have always shaped the nature and content of work:

a. the type of product,
b. the instruments used to produce it.

The literature of the past relates in general to processing activities ("acting"), i.e. work which we would now call factory or site work; much less is known about the design, interpretation and administration activities typical of office work (we are nevertheless aware, for instance, of the social standing and influence of the scribes).

The way in which work has developed over the years tends, for these reasons as well, to be viewed in relation to **advances in machine culture**, i.e. in relation to advances in process technology.

If we continue along this path, office work seems to be much more stable over time. The innovative techniques and instruments which have gradually been introduced throughout the history of human work have tended to reduce physical fatigue and muscular effort and it was only recently that any attention was paid to simplifying and speeding up intellectual work.

Looking at the relationship between working methods and

technological advances, there have been periods when there seems to be little connection between them. This lack of connection is linked not only to the discovery of new innovative principles but also to the fact that a set of technological, economic and social circumstances manages to impose a certain threshold of dissemination on new innovative principles causing a more genuine shift in the centre of gravity of working methods than the development itself.

Historians speak in these cases of a "new era" when referring to the remote past and of "revolution" (for instance the industrial revolution) when referring to more recent periods.

The first industrial revolution is linked, as we know, to the first major applications of thermodynamics (steam engines) and the interpretation of labour organization which was systematically defined at the beginning of this century in Taylor's theory of scientific management.

It is fashionable nowadays to "coin" new industrial revolutions - people talk about the third and even the fourth industrial revolutions - while the Taylorian model is still widespread in practice among firms producing goods and services throughout the world, although it is gradually (and in some cases rapidly) becoming outdated.

In this sense we are living through the dawn of a revolution in working methods or, to put it another way,

the dawn of a "neo-industrial" revolution.

Simplifying our terms as far as possible, the core of the problem lies in the fact that technological innovation - especially innovation linked to informatics - has called into question one of the key principles of Taylorism, i.e. the attempt to reduce any scope for discretion by workers to zero in methods of work directed by others.

Paradoxically, current innovation is achieving "Taylor's dream" (human work which can be standardized is being taken over by machines which obviously have no discretion), while human work is tending to be concentrated in the area of managing discretion or, in other words, those areas which cannot be formalized by classic types of labour organization.

The introduction and ever more rapid dissemination of artificial intelligence, both in systems producing tangible goods and systems producing intangible goods (services), has to be seen as the trigger and prime mover of this revolution.

The impact which this technology has had in practice in the various working situations is neither simple nor unequivocal.

This is the result of many contributory factors and one factor in particular: the way in which labour is organized is the result of decisions, albeit mediated,

but in the end of a discretionary nature, by management.

It may well be expedient for managements to retain the classic models of labour organization even when new technology is being introduced on a massive scale. It is only as time goes by, only when these choices start to have an adverse impact on productivity, that there will be a natural movement towards new forms of labour organization.

To put it another way, there is generally a time lag between technological innovation and organizational change.

4.2 Developments in manufacturing activities

There is an impressive amount of literature on recent (over the last two centuries) advances in "instrumental" manufacturing activity (longitudinal flow of goods/products of Fig. 4).

The basic stages can be summarized as follows:

1. *discovery of artificial intelligence;*
2. *mechanical specialization: i.e. division of labour by specialist and specific resources;*
3. *mechanization or replacement of human work by specific and inflexible resources;*
4. *transferral: i.e. integration of specialist machines in a single production system;*

5. *automation as a "flexible" substitute for human work using multi-purpose production resources;*
6. *monitoring, i.e. intersection of automation with flows of multi-purpose information;*
7. *flexible manufacturing systems, i.e. integration of automatic systems and monitoring systems.*

It is important to stress that the link between the information flow of messages and the physical flow of materials becomes important from stage 5, i.e. automation.

It is only from stage 5 on that the factory acquires its "multi-faceted two-dimensional split" between reasoning and acting.

4.3 Development of office work

There is much less literature on the development of office work. If we follow the same logical scheme used to interpret developments in factory work, the innovative principles have to be sought among those facts and events which have modified or are modifying:

- *the information flows passing through offices;*
- *the flows of materials (paper) which are the carriers of this information.*

If we look back to the representation of the office in Fig. 1, these principles have to be sought in:

- *the technology used to process the written word, the*

spoken word and the image;
- the technology used to transfer and communicate the written word, the spoken word and the image;
- the technology used to record/store the written word, the spoken word and the image.

This technology is changing the way in which the messages entering and leaving offices are assembled, sorted and transferred and is having an immediate and direct effect on creative, interpretative and decision-making processes.

Pinpointing the innovative principles which underlie technological change in the processing, communication and storage of the written and spoken word and the image goes some way towards explaining changes in office work but does not provide any direct information on the change in the essential nature of occupational skills.

In other words, technological change may help us to understand how the mix of occupations is changing in offices but further consideration is needed to find out if and how occupational skills are involved.

If we look at the history of mechanical advances in office work from its origins to the first half of our century, we can pinpoint the following critical stages:

a. *Processing of the written and spoken word and of images*

The technology used to process information underwent few far-reaching changes from the stylus of the scribes to the quill pen and the metal nib, i.e. up to the second half of the 19th century.

The first major innovation came with the advent and rapid spread (at the beginning of the 20th century) of the typewriter which to some extent standardized the processing of the written word (digitalization of a continuous analog process: "handwriting").

b. *Communication and storage of information*

While the typewriter was the innovation which revolutionized writing techniques, the telephone and telegraph were the main innovations in information communication, and the phonograph - connected at the outset to a perforated metal tape and then to a disc - was the innovation which opened up new ways of storing information.

After these basic instruments had been developed, it then became possible to combine and enhance them.

The combination of the typewriter and telegraph led to the teleprinter; the telephone and phonograph provided the telephone answering machine. The storage of phonetic

codes on a (phonograph) disc could be replaced by the storage of graphic codes (writing, data storage). The mechanical, electromechanical and electromagnetic technology of the first half of this century made it possible to construct an extremely innovative architecture for information in which writing techniques, message communication and information storage underwent far-reaching changes with a quantum leap in quality, productivity and efficiency which was far greater than the improvements of the past.

If, however, we look at these changes in depth, it can be readily seen that they had little impact on the information itself.

While it was possible to write in a more standard and rapid way, to sift text at any distance and to store information in files which could be accessed more rapidly, the information itself could be processed only through direct human action.

The advent and rapid spread in the second half of this century of electronic processing and storage was a breakthrough which had a massive innovative impact on office practices: people speak in this respect of the "era of informatics and telematics".

Looking at all these developments in a very summary way, the technological advances can be separated into three main stages:

- *manual stage from the beginning to the mechanized stage;*
- *mechanized stage from the appearance of electromechanical devices to the advent of the electronic memory;*
- *automated stage beginning with the advent of computers and electronic memories.*

The manual stage is far from being a thing of the past, and probably predominates in the offices of many professionals and small companies.

Work in this type of office is of much the same type as in craft firms.

Each worker normally carries out the entire cycle of operations; the overall flow of work is divided between a number of people into parallel and independent flows, in which each worker produces finished work and has considerable flexibility of performance and service. The main feature is the absence of any formal organizational structure: each worker can work in his own way and interpersonal relationships are very important. Since they are highly flexible, these offices can be readily converted from the manual to the automated stage.

The mechanized stage developed (as electromechanical message processing technology gradually became available) in those contexts in which the large volume of information to be processed justified the investment and

changes needed.

This took place simultaneously with major industrial development. Its main features lie in the division of labour within the overall information processing cycle and the proceduralization of the work itself. This office takes the form of an assembly line along which the final information is manufactured, moving from one specialist station to another until the cycle is complete.

In an office for the procurement of spare parts for machinery, for instance, the work cycle for the issue of a purchase order is as follows: updating of the warehouse stock situation, checking whether or not back-up stocks are available, decision to purchase, compilation of a purchase order, issue of the order and negotiation with the supplier, receipt of the goods and acceptance testing, warehouse storage and authorization of payment.

In the "craft" office these stages are generally managed by a single person who consequently needs a range of skills relating to reliability, administration and purchasing.

When there is a very large flow of orders, however, each stage of the overall cycle becomes a specialization: the scientific management of labour attempts to formalize each specialization as far as possible so as to "rationalize" the use of technological equipment and

human resources in the best possible way. Work is sub-divided and specialized, while the organization and the hierarchy of supervisors (managers and executives) have the task of bringing together the specialist stages to produce the overall result.

This leads to the proliferation of a large number of trades generally linked to the different ways in which offices are physically and logistically structured and within which there are departments containing comparable single-skill occupations.

In the automated stage (computerized office) it is to a large extent possible to revert to the craft office model, with an almost complete recovery of the multi-skilled and overall nature of work. The mechanisms, however, differ greatly.

In effect, the stages assigned to man relate essentially to interpretation and decision-making. In the example discussed above, they involve decisions to purchase, negotiations with the supplier and checking of the goods delivered.

An infinite number of examples including insurance companies, estate agencies, travel agencies, etc., could obviously be provided. The basic fact is that the computerized office is paving the way throughout the world for the vertical and horizontal integration of the flow of work entailed in the processing of information: a

flow which had been broken up, for reasons connected with rationalization and efficiency, by the scientific management of labour and which can now be gradually re-assembled to make the most - at the more advanced level allowed by new technology - of those same opportunities for flexibility, efficiency and productivity.

Analysis of the advances in machine technology highlights a general trend which is common to factories and offices. ***Technology undoubtedly has a considerable impact on the mix of professions: when equipment is highly standardized and inflexible, it has the effect of increasing the number of trades and thus the specialization in individual fields; where there is considerable flexibility and informality, it tends, in contrast, to reduce the number of trades and increase specializations covering a number of fields and thus multi-skill occupations.***

This assertion makes it possible to formulate useful considerations about the system of occupational skills but is not, however, sufficient in itself.

While it is true that it helps us to understand which trades are growing and which trades are decreasing in importance and which trades are appearing and which trades are disappearing, it says little about their content.

If we are to find the answer to this second question we have to grasp the relationship between the nature of innovation and the structure of job skills.

CHAPTER V

THE RELATION BETWEEN TECHNOLOGY AND ORGANIZATION AND THE STRUCTURE OF JOB SKILLS

5.1 The reference scenario

In outline, leaving aside the complexity of cultural and social relationships involved, work can be seen as the product of two basic dimensions: "reasoning" and "action":

- the "reasoning" dimension is linked to the generation and processing of information (incoming prescriptive and explanatory messages outgoing as modulated information providing evaluations and answers and transmitted or sorted information);
- the "action" dimension concerns the modification of material and is guided and assisted in turn by the "reasoning" dimension.

We have also seen that the main characteristics of both these dimensions of work are: creativity, decision-making and interpretation, level of informality and specific contribution. Work is carried out through the following stages: preparation or planning, performance or achievement and supervision or checking that performance is in conformity with plans.

The "work system" is extremely complex: in the preceding pages we have highlighted a syncretistic sequence of interdependences between some of the variables involved and a diachronic sequence between technological advance and changes in the structure of work which can be summarized by the schemes set out in schedules A and B below.

SCHEDULE A: MANUFACTURING ACTIVITIES

INNOVATIVE PRINCIPLES	*FEATURES OF WORK*
	FACTORY
1. Discovery of artificial energy	*1. Acceleration of the production capacity of work, replacement of human energy in materials processing*
2. Specialization of machines	*2. Division of finished saleable work into partial unsaleable work* *Rationalization and reduction of workers' discretion*
3. Mechanization of work	*3. Replacement of segments of work which can be completely formalized by mechanical resources* *Increase in the importance of specialist components of work*
4. Transferral/ machine integration	*4. Proliferation of the mix of professions with further specialization and restriction of the individual's area of*

	operation *Integration at the company hierarchy level*
5. *Flexible automation*	5. *Increase in the importance of the top levels of occupational skills, increase in the level of informality of work as a whole, appearance of the single-skill two-dimensional nature of factory work*
6. *Monitoring of automation*	6. *General spread of high levels of informality in work, multi-skill two-dimensional nature, new reasoning model based on the interpretation of abstract (computer) symbols, representing concrete facts, reduction of the mix of professions and and appearance of integrator profiles at various levels, especially in factories*
7. *Flexible integrated systems*	7. *Identification of models of reasoning and action.*

SCHEDULE B: OFFICE WORK

INNOVATIVE PRINCIPLES	*FEATURES OF WORK*
1. Invention of the typewriter *2. Telephone/telegraph* *3. Teleprinters*	*1.2.3 Acceleration of craft office work, division of overall information processing work, proliferation of the mix of professions, level of specialization, major increase in the formalization of work*
4. Automatic information processing *5. Computers and integrated information systems*	*4.5 Gradual recovery of the complete nature of information processing, recovery of the informal dimension of craft office work at a higher level of interpretation and decision-making, reduction of the mix of professions and appearance of integrator profiles.*

These considerations highlight three basic trends from the point of view of the occupational skill structure:

1. *technological innovation is inexorably causing the division of labour between manual and intellectual work to become obsolescent and is tending to convert operating units into centres which manage information at the same time (multi-skill two-dimensional nature);*

2. *there is a gradual movement towards the integration and partial overlapping of the planning, performance and supervision stages in the dimensions of both reasoning and action;*

3. *a "matrix" transformation of the structure of job skills is taking place everywhere; i.e. there is a trend towards a network "distribution" (10) of tasks.*

If we are fully to grasp these changes in job skills we have to take account of a fact which makes this reasoning much more complicated: the impact on these job skills of the mutual relationship between technological innovation and labour organization choices.

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(10) Innovation (expert systems) is providing the "integrator" profiles discussed in point 2 with increasingly advanced specialist knowledge thereby reducing the number of specializations directly involved in the solution of individual operating problems and bringing about considerable increases in efficiency.

Although the introduction of new technology modifies the structure of job skill needs, understood as a set of trades or professions, the way in which it is linked to labour organization choices determines the job skill content, i.e. the skills and expertise which underlie these trades and professions.

In other words, technology gives rise to new needs but, at least in the short and medium term, it is the organization which reaps the opportunities and constraints linked to the new needs.

It is not easy at present to give a clear picture of the structure and content of job skill needs.

Fig. 6 shows a hypothesis which the authors feel is the most realistic and plausible.

This diagram highlights the mutual effects between new technology and labour organization (11) likely to

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(11) In any system it is the organization which prescribes and specifies goals, responsibilities, tasks and operating methods. If the system is complex it can be divided into sub-systems right down to its individual components which are administered in a similar way in accordance with a pattern of recurrence. The organization defines the methods through which the various factors of the system can be integrated and caused to act in productive terms both as single components (efficiency) and in terms of their overall interaction (effectiveness). The organization achieves its goals though a process of proceduralization, i.e. through a comprehensive set of prescriptions: what, who,

determine the new structure/content of job skill needs.

The basic stages of this hypothesis are as follows:

- *The proceduralization of work affects the mix of activities by breaking it down into three sub-groups: completely formalized work, informal proceduralized work; creative, interpretative and decision-making work.*

- *New technology replaces formalized activities by shifting the mix of work towards informal creative, interpretative and decision-making activities.*

- *The effect of new technology in the area of informal proceduralized activities is to introduce a new model of thought (a new way of doing things).*

- *New technology has little chance of replacing human creative, interpretative and decision-making work, but is able to enhance the potential and scope of such work when introduced into a culturally prepared context able to grasp the significance of the new and different in creative terms.*

- *New technology may also diminish human creative, interpretative and decision-making potential when introduced into a culturally unprepared context and*

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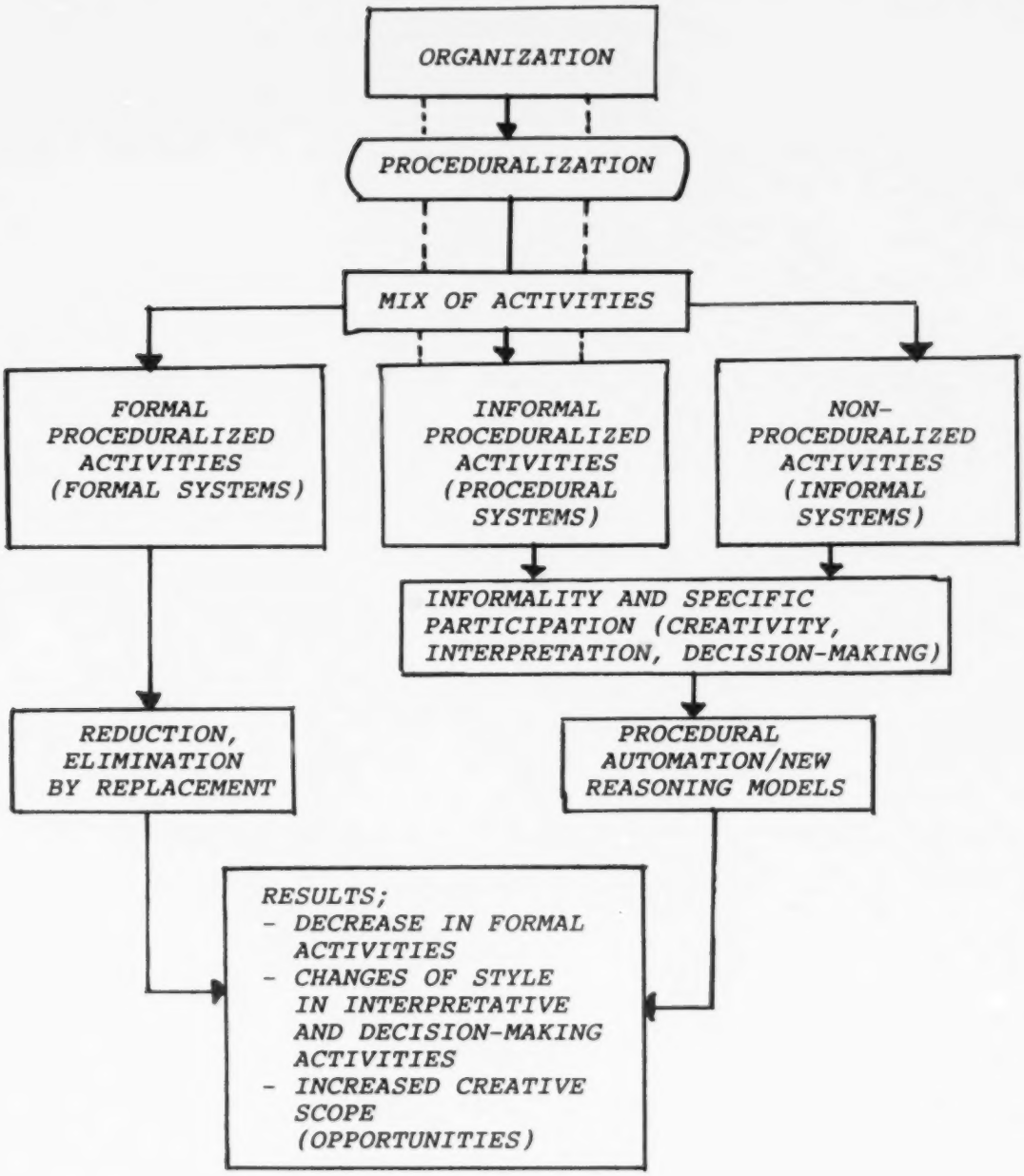
when, how, how long.

may therefore lead to a retreat into the mechanistic and to alienation.

If, as is to be hoped, the "progressive" path is chosen, the cycle can obviously be repeated leading, as a general trend, to a progressive reduction of formal activities, an on-going change in interpretation and decision-making methods and the continued growth of creative opportunities.

Fig. 6


ORGANIZATION
PROCEDURALIZATION
MIX OF ACTIVITIES
FORMAL PROCEDURALIZED ACTIVITIES (FORMAL SYSTEMS)
INFORMAL PROCEDURALIZED ACTIVITIES (PROCEDURAL SYSTEMS)
NON-PROCEDURALIZED ACTIVITIES (INFORMAL SYSTEMS)
INFORMALITY AND SPECIFIC PARTICIPATION (CREATIVITY, INTERPRETATION, DECISION-MAKING)
REDUCTION, ELIMINATION BY REPLACEMENT
PROCEDURAL AUTOMATION/NEW REASONING MODELS
RESULTS;
- DECREASE IN FORMAL ACTIVITIES
- CHANGES OF STYLE IN INTERPRETATIVE AND DECISION-MAKING ACTIVITIES
- INCREASED CREATIVE SCOPE (OPPORTUNITIES)

5.2 Field surveys

The reference scenario discussed in the previous section is the result of a number of field surveys in the industrial sector (12).

The critical point of this approach lies in whether the concepts which govern the relationship between technology, organization and job skills can be transferred to contexts other than the industrial.

We feel that this transfer is plausible for two main reasons:

- the trend, which many have noted, towards the standardization of the management cultures and styles governing activities in the primary, secondary and tertiary sectors (business logic is tending to become more uniform and the boundaries between the three sectors are becoming ever more blurred);
- the way in which new technology (computers) is penetrating all the sectors and giving rise to problems which are very similar in terms of their

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(12) The authors have referred in particular to the research conducted in this sector by the Fondazione Agnelli in Turin over a ten-year period (see "Come cambia la fabbrica" [How the factory is changing], various authors, Turin, 1986, Ed. Fondazione Agnelli) and by ENFAPI Servizi Formativi Confindustria (see "La fabbrica: camminando con l'innovazione" [The factory: moving with innovation], various authors, Rome, 1987, Ed. Sipi).

impact and the changes they are causing in job structures. We refer in particular to the problems linked to CMW (computer mediation of work).

These considerations are borne out, as we will see below, by the surveys conducted in an important area of the service sector (banks, finance, insurance).

It may therefore be useful to give a brief outline of the current situation and future prospects of the industrial sector.

If we look at the five conventional classes of factory activity (equipment, processing, transport, testing/ checking, maintenance) which are in practice contained from a conceptual point of view in any work situation, innovation (technological and organizational) is mixing and integrating jobs previously rigidly separated by the logic of scientific labour management. The factory situation is tending, in this respect, to move closer to the office situation in those cases, for instance, where the same employee is responsible for equipment, processing, transport, checking and day-to-day maintenance.

This is due, on the one hand, to technology (automation) and, on the other hand, to organization (production flexibility).

The critical areas (13), rather than handling, repair and replacement, are prevention, continuous control and the correction of technical discrepancies in order to achieve an output of the desired quality (14).

Seizing the opportunity to change to systemic types of labour organization is a trend taking place in a more conscious way in major firms and a less formal way in small-to-medium firms (see the research by the Fondazione Agnelli and the Federazione degli Industriali Veneti mentioned above): organizational choices are increasingly becoming variables mutually dependent on technological variables.

In this uncertain, but rapidly changing, context, new occupational archetypes are gaining ground: the most typical of these emerging profiles is probably the operator. The operator is the most striking example of the breakdown of conventional profiles in terms of multi-functionality:

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(13) This concerns smaller firms as well as major enterprises as shown by a study being conducted by the Federazione degli Industriali (Federation of Industrialists) of Veneto.

(14) In addition to emitting "strong" signals showing the deterioration of the functions of the system, new technology provides the operator with a variety of "weak" signals which, when interpreted creatively, make it possible to prevent discrepancies, i.e. to get ever closer to optimum operation.

- *the operator is required, on the one hand, to perform processing tasks, but in a new way (he can act on the process parameters of the segment of the technical system which he is operating and can carry out basic programming);*
- *on the other hand, the operator is also required to perform many auxiliary tasks (day-to-day maintenance in self-diagnostic systems; equipment, by adjusting machinery through procedures controlled from a video keyboard; movement, through requests for materials and on-going stock-taking).*

A further important profile is in the area of maintenance: the "electromechanical engineer": a multi-skilled maintenance engineer in the sense that he is able to maintain the electronic as well as the mechanical parts of equipment.

The above examples highlight the two main groups of job skill needs emerging in factories:

a. *a new family is emerging, i.e. operation, with all its implications in terms of inter-functionality and CMW (computer mediation of work);*

b. *growing importance is being attached to specialists (the electromechanical engineer is a maintenance specialist) of increasingly advanced level able to encompass a number of disciplines in keeping with increasing technological complexity (multi-skilling).*

If we look at job skill contents (abilities/knowledge) the most drastic changes are taking place in the area of "operation".

The shift away from the direct perception of the action (traditional processing operatives) to a perception mediated by the computer system entails more highly developed skills of abstraction and interpretation of advanced symbolic languages; inter-functionality, on the other hand, requires the ability to assimilate the various signals in a comprehensive way. The ability to concentrate (to pick up any "weak" signals) and to make decisions (prevention of anomalies) are also important, while they were far less use to or were not required from traditional operatives.

Alongside these emerging needs, the scope for job skill needs of a traditional type in the actual situations surveyed (15) is obviously very broad. The important fact is that in the majority of cases these needs are being changed in a relatively far-reaching way.

All employees, formally recruited for low-level single-skill jobs, are now being required to have a basic training which allows them to switch over to related jobs and to interact with the specializations linked to their

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(15) See the research by the Fondazione Industriali Veneto discussed above.

jobs, i.e. an "interfacing" component (multi-skilled sectoral employees).

This is being accompanied by a trend towards a simplified range of occupational profiles related to archetypal training schemes, transferring the task of providing "final" occupational profiles to "on-the-job training".

It is thus possible to pinpoint a small group (16) of occupational archetypes able to cover a very wide range of needs in a range of industrial sectors both in relation to present operation and in relation to predicted technical and organizational changes.

Looking at the content of job skills, the surveys show that skills are now being seen as less critical than cleverness, i.e. the logical skills needed to implement action making effective use of the increased (and increasing) scope for discretion (we speak in this respect of "enhanced workers"), and show that there is an emerging need for an improved culture of production seen as a whole, as well as a high dose of motivation, to take account of the increasing informal scope for participation (improving production and creativity of

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(16) Fifteen or so archetypes in the operating area of product industrialization; a further twenty or so covering the remaining areas: administration and control, personnel and labour organization; information systems, research and development, sales and product marketing technicians (see the research by the Federazione Industriali Veneti).

work (17)).

In conclusion, looking at the operational level of factory production, the components which are fairly widespread and explicit features of the new job skills can be summarized as follows:

- *increasing inter-functionality of tasks;*
- *changes in the reasoning model for task performance;*
- *changes in the cultural approach (from retrospective action to creative prevention).*

Once the trend towards a systemic type of labour organization in factories has got underway, it seems to bring about (almost unavoidably in this case) far-reaching changes in the entire system.

In practice the local performance level which can be obtained from the "operator" does not in itself ensure the overall performance level of the process, just as the performance level of the process is not enough in itself to ensure the optimum final result (of the process network).

Starting from the basic situation represented by the operative, there is a need for optimization at each level which can be achieved only through "integrator" personnel

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(17) For this reason the term "participation" takes on a new and more complicated significance than in the past.

(18).

A diagram of this approach is shown in Fig. 7. This may be of use for the following reasons:

1. the new occupational profiles (in the strict sense, i.e. directly connected with innovation) are integrator profiles;

2. their job skills are of the "matrix" type, in the sense that the specialist centres operating at the various levels converge on them;

3. each level contains, through integration, all the necessary specialist knowledge relating to this level and to lower levels;

4. the overall result of the work (whether at the planning or management stage) is always a team result;

5. the nature and goals of the hierarchical system change significance in a far-reaching way;

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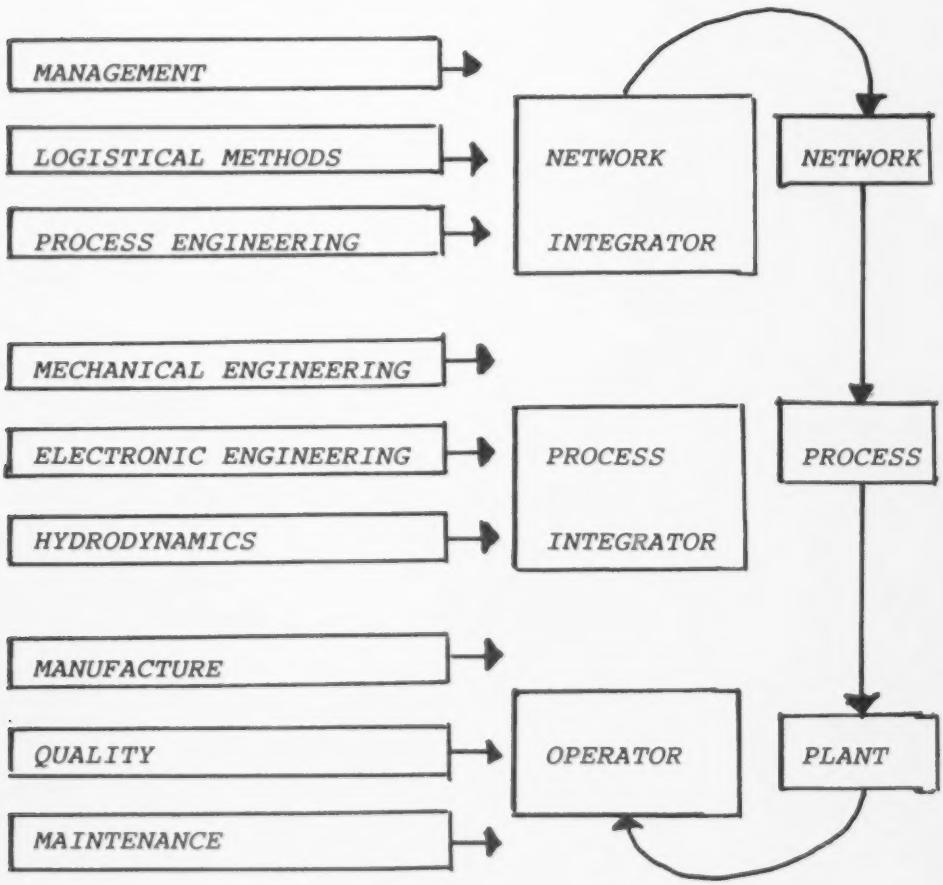
(18) At the level above "local operation", the "process integrator" is responsible for optimizing the set of activities (by men and plant) which provides an intermediate finished product: for instance the motor of a refrigerator in a factory or a document in an office. At the level above this, the "network integrator" is responsible for optimizing the set of processes which provide the finished product: for instance a refrigerator or an annual report.

6. *optimization entails new (and conceptually very different) models of reasoning in comparison with the case of specialist task-orientated organizations.*

Fig. 7



5.3 Possible developments

The existing literature and experience in Europe, the USA and Japan points to three main scenarios which we consider worth discussing in relation to potential developments in the situation described in the preceding paragraph:

a. spread of the situation described in the previous section, based on the use of first-generation artificial intelligence systems;

b. development and spread of second-generation artificial intelligence (expert systems);

c. total integration.

Scenario A

If the present scenario is to become more widespread the factors of change discussed above will gradually have to take root. In this scenario, the first step will be the increasingly widespread use of replacement automation (office automation in offices) with the gradual elimination of manual and routine tasks which can be readily prescribed and formalized.

The second step will be the use of flexible procedural automation, i.e. the use of computer-aided procedures assisting in the performance of the work cycle.

The third step will be the consolidation of new organizational philosophies with the introduction and spread of new models of responsibility aimed at further task rationalization and allowing production and quality goals to be more effectively pursued.

Scenario B

If expert systems are introduced and become widespread, the main difference with respect to the previous scenario will lie in the fact that part of the "on-going improvement" process will be delegated to the expert system (19) increasing the operator's scope for discretion (creativity).

Scenario C

The total integration scenario (which is tending to take hold in Japan and in some American experiments) is the most innovative. Irrespective of the level of technology introduced (first-generation artificial intelligence, expert artificial intelligence) it is based on a different philosophy of regulation and organization, able to link what is happening at one stage of the production process with the stages upstream and downstream and to

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(19) One of the features of second-generation artificial intelligence is that it issues instructions, "reasoning" by inference from the set of rules with which it has been provided.

transfer production correction, acceleration and deceleration instructions in real time. This philosophy makes it necessary to interlink information (using a system of computers) from all the processes involved in both the parent company and the supply network.

If this scenario is to be implemented, the organizational diagrams of the previous scenarios have to be re-designed from the performance worker level. The main feature of total integration systems lies in assigning operators at the lowest level some part in regulating actual production flows in addition to the responsibilities contained in scenarios A and B.

The critical nature of this scenario is to be found in the total flexibility of the labour factor (job skills and flexibility of service).

The main features in terms of new job skill needs in respect of these three scenarios can be summarized as follows:

Scenario A: the mix of professions and skills changes; new profiles emerge for specialists as well as a new jobs with an integrator profile; this leads to new skills based on different multi-disciplinary and multi-functional reasoning models.

Scenario B: the change in the mix of professions is

accelerated in comparison with scenario A, the number of interdisciplinary skills increases and the outdating of the division of labour is accentuated.

Scenario C: simultaneously modifies job skills at all levels of the organization; further accentuated change in the mix of professions, need for maximum participation on the part of workers.

The potential consolidation of one of these three scenarios depends largely on factors external to production in the strict sense.

The most probable scenario in Europe, at least in the medium term, seems to be the first, bearing in mind on-going technical problems with the development of expert systems and the present culture and regulations relating to labour.

5.4 Identifying occupational archetypes - a reference model

On the basis of the considerations discussed in section 5.2 as regards trends surveyed in the field and in section 5.3 as regards possible developments, training archetypes can be rationalized as follows.

The overall skill needs which are emerging are of two

main types:

- ***specialist,***
- ***integrator.***

In the past job skills could largely be described with reference to specialist skills alone. Innovation (both technological and organizational) has given rise to a new and complex range of integrator occupations.

Jobs of a specialist type do not in the final analysis entail working methods differing greatly from traditional methods. The core of these jobs lies in the ability to interpret, infer and decide, i.e. skills whose importance has grown with the new technology, but whose content has not changed. The main changes concern the expertise, in relation to external factors, contained in advances in basic disciplines and the discovery of new technical solutions, new needs and so on.

Integrators (who work in a dimension transverse to specialists) are strongly linked to a new and different method of production. It could be said in this respect that these occupations are emerging from "inward looking" factors (factors inside the production model). It is these which are the genuinely new occupations. Their reasoning model is broadly comparable within every sector and industry. The skills which they have to possess, in terms of interpretation, decision-making and creativity, are systemic.

The link between technology, organization and structure of job skills can be summarized as follows:

- *external factors bring about changes in the specialist dimension;*
- *internal factors bring about changes in the integrator dimension.*

One of the main features of the occupational scenario in the near future will be the growing need to define the identity, image and role of integrators whose numbers seem set to proliferate in every sector of activity (20).

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(20) Some of these profiles are well known (operators, process integrators, network integrators) others are less well known (robotics, office automation, automated agriculture, automated banking, automated tourism).

CHAPTER VI

NEW JOB SKILL CONTENTS AND NEW INDUSTRIAL RELATIONS AND TRAINING PROBLEMS

While the old conception of work was based on the implementation of predetermined canons, the new conception is based on the continual outdating of these canons. Work is tending for this reason to take the form of a permanent creative process. This new type of work raises a number of questions:

- *what does it imply in terms of job skills; in particular, how does the creative process function in an organization, what relationships are there between human resources (specialists, integrators and hierarchical systems) and what relationships are there between human resources and technical systems?*

- *what problems are raised in terms of industrial relations and in particular what mechanisms can be used to motivate and encourage people to move towards these new methods?*

- *what problems are raised in terms of training and in particular what types of action have to be envisaged to develop the skills emerging within a process moving towards permanent creativity?*

6.1 Implications for job skills

The diagram of Fig. 7 can be read as a ***continual process of optimization****: each individual optimization plays its part in the subsequent stage until the final result is achieved; the final result provides a retrospective*

signal for the re-adjustment of the circuit as a whole. Since no level can function without the previous level, the critical factors in terms of human resources lie in three areas:

- *individual creative contribution;*
- *optimum contribution at one's own level;*
- *synergic contribution between successive levels.*

6.1.1 Individual creative contribution

The conventional content of the areas of informality within traditional labour organization (where prescription presents problems or is impossible), focused essentially on interpretative skills, is expanding and shifting towards deduction skills (systemic creativity). In practice, the fact that the level of individual performance depends on interactive and interdependent variables within and outside the job brings into play the ability ("systemic creativity" or "deduction") to manage the recurrent transaction diagram in an optimum way. Recognizing the relationships between the variables involved (which can to some extent be prefigured and delegated to the technical system) is not as important as implementing the best possible action in a timely way, i.e. providing the diagram with practical significance.

6.1.2 Optimum contribution within one's own level

At each level of the diagram of Fig. 7, performance

depends not only on individual performance potential but on the ability to adjust in relation to the flow of information from allied positions. Optimizing performance at a given level therefore depends on self-adjustment capacities.

6.1.3 Synergic contribution between successive levels

Synergy between different levels entails, in terms of job skills, the ability to interact to an extent which increases from one level to the next.

This is the most complex and problematic skill in the whole structure of the new job skills. Three components underpin it:

- *knowing how to find the "critical path", i.e. knowing how to choose those variables likely to have an impact on the desired result from all the variables;*
- *knowing how to backtrack, via the critical paths, to earlier causes: "event regression";*
- *knowing how to find "adaptation strategies", i.e. the action to be implemented and the priorities to be respected.*

These three components give rise to what labour organization experts call the "synergy diagram" which shapes the whole philosophy underlying the new working methods.

6.2 Implications for industrial relations

We feel that some discussion of the implications for industrial relations is needed, even though this lies outside the actual scope of this report.

The new job skill archetypes, based on a growth of the areas of informality which are delegated (systemic creativity) and on horizontal and vertical integration (self-adaptation and interaction), do not entail anything particularly new in the higher tiers of the organization (they are in effect the norm for management), but offer a somewhat momentous challenge for the lower tiers: far-reaching changes in hierarchical structures, management styles and models of in-house and industrial relations. This new challenge can be seen in some ways as a transition towards a new philosophy of participation.

If we look at the debate which took place in previous decades and which was based on two traditional pillars, those of individual self-realization and social control of the exercise of authority in a context of industrial democracy, this approach is being thrown into confusion by an emerging and fundamental fact.

This new philosophy of organization makes participation into a component which is <u>required</u> rather than <u>allowed</u>: put slightly differently, it loses any ideological value and becomes a key factor in business policy.

In other words, in a context where the key factors in success lie in the ability to manage ambivalent events, results cannot be achieved by inflexible and obstructive attitudes. Attitudes of awareness and participation in respect of the final goal are needed: the extent and the level of the exchange between the sides is changing and increasing. This necessarily entails the removal of many of the barriers of the past and in particular an awareness that the new model of participation is changing the rules of the game (and the rituals associated with it): in terms of the continuity of social planning, in terms of major involvement in its management and in terms of different ways of interpreting the auditing tasks of the unions to prevent the increased scope for discretion from leading to the paralysis of the system.

Comparative analysis of the most significant experiments in those countries with advanced industrial economies shows that the following components are an important part of the new models of participation:

- *reorganizing manual and non-manual work;*
- *making the team collectively responsible (in the area of manual work at least) for volume, quality and cost goals;*
- *launching methods for the vital and permanent communication of general and particular information relating to the tasks assigned;*
- *recruitment and continuing training methods designed to provide a stock of human resources in keeping with*

company needs;

- pay which is in keeping with the results of work, generally the results of team work, placing considerable emphasis on incentives;
- re-designing the role of managers, especially at the lower end of the scale;
- re-designing the ways in which unions and companies relate to one another as well as union control mechanisms.

6.3 Implications for training

The new factor which is likely to have a substantial impact on human resource training systems, over and above the new contents, lies in the fact that job skills are becoming an interactive factor in the new philosophies of production organization rather than a variable dependent on the organization itself.

Job skills are in this respect becoming an integral part rather than a result of investment: it is therefore becoming necessary to launch regular "maintenance" schemes, i.e. to provide training throughout working life (21).

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(21) According to estimates by a number of multinational firms, refresher training should be provided for 3-4 months every 4-5 years. This adds up to 630 days out of working life as a whole (35-40 years): additional employment of some 5% would be created in these circumstances.

On the other hand, bearing in mind what has been said above, the new job skills (22), viewed in terms of training needs, have three main components:

- *the basic knowledge typical of the particular occupation;*
- *the reasoning model linked to the "networking" of tasks in computer mediated activities;*
- *the reasoning model linked to the permanent creative process, based on the interaction between individual intelligence and collective intelligence, i.e. the intelligence of the surrounding system.*

The first component which is specific by nature is the component which traditional systems conventionally develop.

By way of contrast, the second and third components are highly innovative and are seldom satisfactorily handled by training systems.

The skills which need to be developed are those relating to:

- *processes of interpretation,*

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(22) It should again be stressed that these considerations relate to human activity as a whole in any context where technologically advanced computer systems have been introduced, whether they fall under the heading of industry, agriculture or the service sector.

- *processes of systemic creativity,*

the most important of which are:

- ***Conceptualization:***

Recognizing the components of a whole, identifying their characteristics, classifying them in comparable categories, combining the sub-groups by functions and attributes, etc.

- ***Locating cause-effect relationships:***

Linking concepts by cause-effect relationships, discovering their functions and using this to locate the expertise which is needed.

- ***Memory organization:***

Enlarging the memory capacity by developing a network of affinities and differences between concepts.

- ***Selective memory use:***

Using the organization of the memory to compare semantic and perceptive categories with one's individual portrayal, grasping any correlations.

- ***Self-observation, self-regulation and control:***

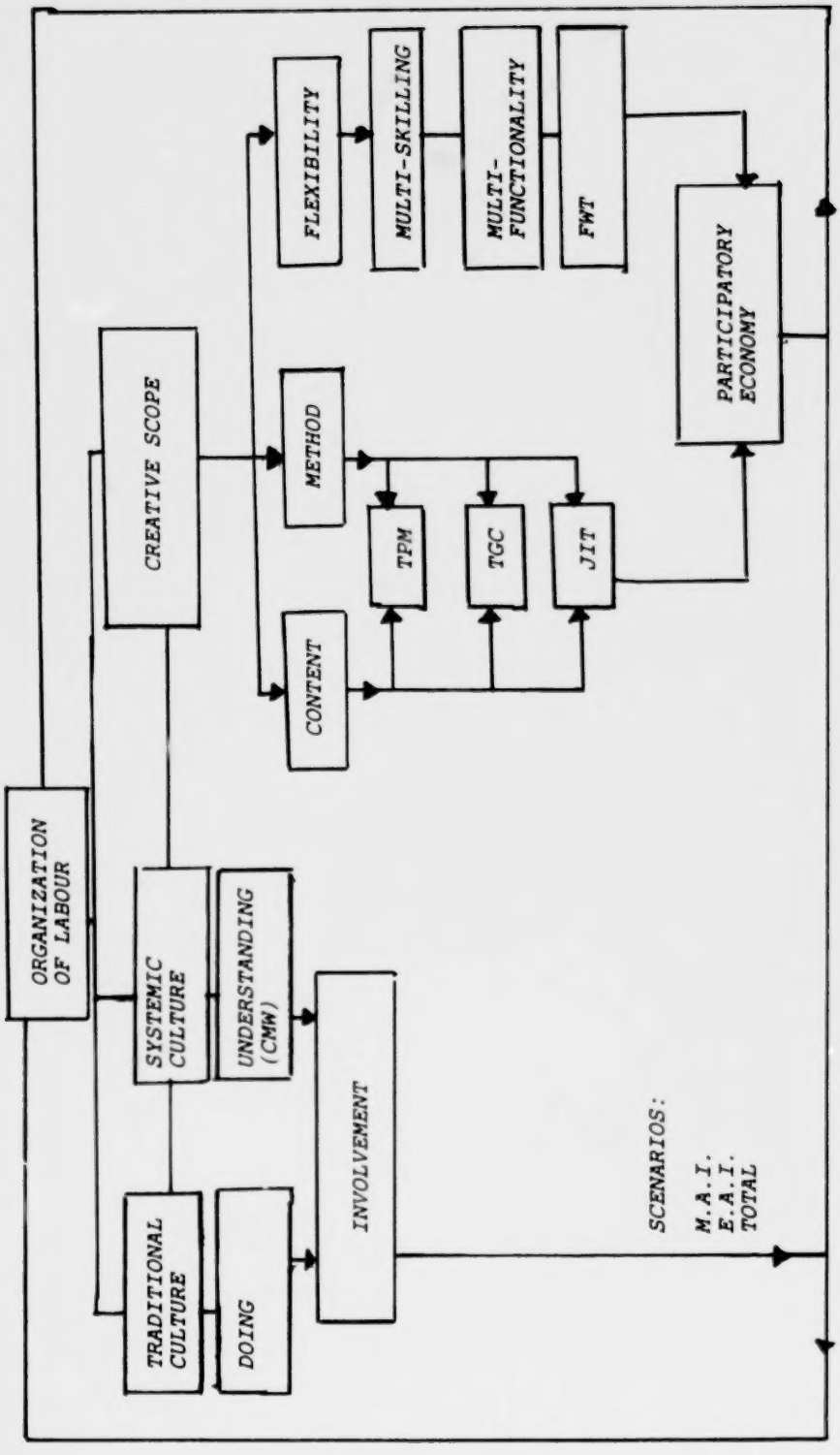
Being able to monitor activities at a collective level in which the separate actions of a number of individuals take on analogous aspects.

- ***Quest for systemic creativity:***
Being able to cause one's own imagination to interact with high technology systems (computer systems, expert systems, automation, etc.).

Most workers employed in innovative contexts have to possess these skills to some extent. They underlie the job skills of integrators in particular, but are also important for specialists who need them to develop and get the most out of their work.

Fig. 8 gives some idea of the way in which the new working methods are linked to the new job skill structures. It also shows the new cultural challenge facing us: job skills are increasingly the result of a symbiotic relationship between technical culture and the expression of logic skills linked in traditional education to the humanities.

Fig. 8: INNOVATIVE TECHNOLOGY AND JOB SKILL STRUCTURE



KEY

CMW	*Computer mediated work*
CIP	*Continuous improvement process*
TPM	*Total production maintenance*
TQC	*Total quality control*
JIT	*Just in time*
FWT	*Flexible working time*
MAI	*Mechanical artificial intelligence*
EAI	*Expert artificial intelligence*
TOT	*Total integration*

CHAPTER VII

ARCHETYPES OF REFERENCE TRAINING METHODS PINPOINTING JOB SKILLS IN THE PRODUCTION SERVICE SECTOR

7.1 ***Methods***

We used the following procedure to rationalize the area of our survey:

7.1.1 *we started from the flow chart of an ideal structure (**metastructure**) and considered all the possible areas within this structure; starting from management and moving down to servicing and after-sales assistance in the case of production of tangible goods and production of a service;*

7.1.2 *we looked at the **basic processes** in all these areas:*

- *design,*
- *planning,*
- *regulation,*
- *performance,*
- *supervision;*

7.1.3 *within each area we looked at **functions**, defined as follows: the set of processes (see 7.1.2) directed at the specific objective;*

7.1.4 *we defined the **archetypal training method for the job skill** in relation to:*

7.1.4.1 *the basic array of knowledge relating to the specific nature of the task (see 7.1.3);*

7.1.4.2 the range of horizontal skills which must be possessed to some extent in relation to the five basic processes (see 7.1.2).

We felt that "hierarchical level" (significant in "top-level" training: managers, directors, etc.) was not particularly important for the purposes of identifying training methods;

7.1.5 We then compared the metastructure (see 7.1.1) with the most recent occupational nomenclatures contained in the following literature:

7.1.5.1 official documents from employers' and union organizations;

7.1.5.2 surveys carried out by public authorities, centres, research institutes and companies (both public and private).

In the case of the more recent professions, we looked at the international literature, especially documentation from multinational firms;

7.1.6 we then attempted to cluster the above nomenclatures around the archetypal training methods (see 7.1.4);

7.1.7 we checked this hypothesis with:

- *employers*
- *labour organization specialists*
- *labour relations specialists*
- *training system specialists*

7.1.8 this led to a set of training archetypes which we divided into two main blocks:

7.1.8.1 ***Traditional archetypes and specialist archetypes:***
we simply listed (or gave a short description of) these archetypes since detailed descriptions can be readily found in the literature;

7.1.8.2 ***Highly innovative archetypes (integrator profiles):***
we built up a reference profile for these archetypes on the basis of the considerations set out in previous chapters and the most recent surveys.

7.2 Area surveyed

The working situations examined were:

7.2.1 Office work in services to production

7.2.2 Financial services work

- *banking*

- *insurance*
- *financial services*

A rapid survey of the following fields was also conducted:

7.2.3 Agriculture

7.2.4 Environment

This was supplemented by a description of four archetypes relating to:

7.2.5 Industry: considered to be of great help in pinpointing a method of defining integrator profiles.

7.3 Office work in services to production

In this case the survey looked at office work serving both the production of tangible goods (industry) and the production of services (established service sector: for instance banks, etc.).

Traditional and/or specialist archetypes

7.3.1 ***Multi-skilled office employee:*** *conventional secretarial work (typing/shorthand, correspondence, etc.) supplemented by the need to use video screen techniques (word processing).*

7.3.2 ***Accounts/administrative management employee***

7.3.3 ***Personnel management employee***

7.3.4 ***Sales employee***

The following archetypes are located among more specialists profiles:

7.3.5 ***Foreign language correspondence clerk***
7.3.6 ***Marketing analyst***
7.3.7 ***Financial analyst/controller***
7.3.8 ***Labour organization analyst***
7.3.9 ***Data processing systems engineer*** *(programmers and analysts)*
7.3.10 ***Purchase technician*** *(buyer)*
7.3.11 ***Sales operative***
7.3.12 ***Communications and image technician***

Innovative archetypes

Highly innovative (integrator profiles) archetypes were only very rarely encountered in this field.

7.4 Financial services

An unpublished survey by the Fondazione Agnelli of Turin was used to identify the archetypes in this sector.

The following archetypes were identified in addition to the office work archetypes listed in the preceding paragraph:

Traditional and/or specialist archetypes

7.4.1 ***Counter clerk:*** *the conventional counter clerk*

responsible (generally using a terminal) for the day-to-day transactions involved in the provision of the product and for managing personal contact between the customer and the firm.

7.4.2 ***Product specialists**: whose main activities currently include:*

- *adapting the technical content of the product to customers' changing needs;*
- *updating their own technical expertise in relation to the product being managed;*
- *specialist procedural work for the provision of the product.*

These main activities are tending to shift towards:

- *adaptation or innovation of the technical content of the product in terms of customers' needs;*
- *management of measures to make products more international.*

As regards the specific content of products, most attention is being paid to the following:

7.4.2.1 <u>Banking products</u>

7.4.2.1.1 Traditional:

- *overdrafts*
- *currency advances*
- *portfolio*

- *documentary credits*
- *medium and long term lire loans*
- *short term lire loans*
- *guarantees*
- *interbank lira*
- *mortgages*
- *general banking services*
- *securities*
- *forward exchange dealing*

7.4.2.1.2 Newer:

- *syndicated loans*
- *bancomat*
- *certificates of deposit*
- *special lending*
- *ATM*
- *bankers' acceptances*
- *home banking*
- *credit cards*
- *spot against forward transactions*
- *cash management*

7.4.2.2 Insurance products:

7.4.2.2.1 Traditional:

Non-life assurance

- *fire*
- *theft*

- *accident*
- *sickness*
- *hail*
- *transport*
- *aircraft*

Life assurance

- *life/life*
- *death*
- *life/death*
- *annuities*
- *collective*
- *indexed*
- *revaluable*

7.4.2.2.2 Newer:

- *common fund/policy*
- *opening current account/policy*
- *goods purchase/policy*
- *insured loans*

7.4.2.3 Financial services products

7.4.3.2.1 Traditional:

- *leasing*
- *investment funds*
- *export finance*
- *factoring*

- *fiduciary funds management*
- *auditing*
- *M & A*
- *placement services*
- *project financing*

7.4.3.2.2 Newer:

- *venture capital*
- *consumer credit*
- *swaps*
- *countertrade*
- *open-ended investment funds*
- *investment banking*
- *commercial credit policy*
- *options*
- *leveraged buyouts*
- *special funds*

Innovative archetypes

Innovation in this sector generally involves the automation of procedures which are already highly formalized as a result of the nature and sensitivity of the product (tending to eliminate any scope for discretion on the part of the operator). However, the boom in these markets and the increased levels of internal competition are causing these attitudes to change.

In terms of archetypes, two main job profiles are emerging from the new organizational philosophies:

7.4.3 Front office integrator

The main activities can be summarized as follows:

- *understanding of customers' needs and optimum matching of the products/services offered by the institution with these needs;*
- *database inputs for administration/control and planning systems;*
- *relaying of indicators of trends and changes taking place in the market to product specialists.*

The annexes to this chapter include a detailed specification of:

- *profile*
- *responsibilities / aims*

7.4.4 Back office integrator

The main activities can be summarized as follows:

- *smoothing/harmonization of ventures concerning the various product lines through the balanced integration of specific operational objectives;*
- *pinpointing of any synergies in development plans for ventures in the sector.*

The annexes to this chapter include a detailed specification of:

- *profile*
- *responsibilities / aims*

7.5 Agriculture

The tide of innovation in this sector is linked, on the one hand, to its increasingly close integration with other sectors (especially industry) and, on the other hand, to emerging production attitudes (maximizing yields, externalization, concentration of distribution systems, high-quality biological products, etc.).

Technical innovation is taking place in a very wide range of areas ranging from chemistry to informatics, energy (biomass), biotechnology and the environment.

However, in relation to job skill needs, completely new profiles are not emerging in terms of archetypal training methods. The most change seems to be taking place in the profile of the agricultural entrepreneur (agricultural company operator) where increasing attention is being paid to the management of variants linked to problems upstream and downstream of production, making use of help (usually by consultation) from specialists.

Archetypes not directly connected with the field of this report are emerging amongst these specialists (product

technicians; process technicians; instrument technicians). The only emerging profile which may come within our survey is:

7.5.1. Agri-informatics technician

This archetype has to possess the general knowledge needed to deal with the various aspects of running an agricultural firm onto which specific skills relating to computer and telematic equipment can be grafted.

Job outlets include agricultural associations and the relevant public authorities as well as business consultancy activities.

7.6. Environment

Despite the very high level of interest and the wide range of jobs reviewed in the literature, our survey of training method archetypes has led to the following conclusions:

- *operatives:*
  materials operatives who need skills which are largely independent of the environmental context;

- *specialists:*
  conventional specialists (engineers, biologists, geologists, etc.) with the focus on (and needing refresher training in) topics such as the

materials/energy balance of production cycles and the ability to conduct objective and subjective environmental impact assessments;

- *innovations:*
  a very high level archetype which falls within the scope of our survey is starting to appear:

7.6.1. Generalist-metaecologist

This is an "integrator" profile since in addition to specialist training this person must be able to look at problems as a whole and interface with the various disciplines linked to the environment (physics, biology, sociology, management).

There are very few job outlets or prospects at the moment, although such profiles are acquiring strategic importance in sectors such as the public authorities, industry, research and communications.

7.7 Archetypes of training methods: a framework

The survey conducted in the sectors of:

- *office work in services to production*
- *financial services*
  - *banking*
  - *insurance*
  - *financial*

- *agriculture*
- *environment*

pinpoints the following 18 archetypes as regards office work:

7.7.1	*Multi-skilled office employee*	*Ref. 7.3.1*
7.7.2	*Accounts/administrative management employee*	*Ref. 7.3.2*
7.7.3	*Personnel management employee*	*Ref. 7.3.3*
7.7.4	*Sales employee*	*Ref. 7.3.4*
7.7.5	*Foreign language correspondence clerk*	*Ref. 7.3.6*
7.7.6	*Marketing analyst*	*Ref. 7.3.7*
7.7.8	*Labour organization analyst*	*Ref. 7.3.8*
7.7.9	*Data processing systems (programmer-analyst)*	*Ref. 7.3.9*
7.7.10	*Purchase technician (buyer)*	*Ref. 7.3.10*
7.7.11	*Sales technician*	*Ref. 7.3.11*
7.7.12	*Communications/image technician*	*Ref. 7.3.12*
7.7.13	*Counter clerk*	*Ref. 7.4.1*
7.7.14	*Product specialist (23)*	*Ref. 7.4.2*
7.7.15	*Front office integrator*	*Ref. 7.4.3*
7.7.16	*Back office integrator*	*Ref. 7.4.4*

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(23) Bearing in mind the large numbers of end occupations, there are many types of product specialist; we have looked at the (traditional and prospective) archetype and some specific applications in the financial sector (banks, insurance, financial services).

7.7.17	*Agri-informatics technician*	*Ref. 7.5.1*
7.7.18	*Generalist-metaecologist*	*Ref. 7.6.1*

It should be borne in mind that these archetypes may be (and generally are to be) found in sectors not included in our survey (for instance travel agency counter clerks).

7.8 Integrator profiles in industrial production activities

Although not included in our survey, we feel that it may be useful to conclude this chapter with a description of the main integrator profiles already existing in industry.

Analysis of job profiles of this type is much more advanced in industry than in other sectors since these profiles are to be found in operating units with highly innovative contexts.

The analysis model for these profiles may help us better to define the integrator profiles emerging in the service sector (have integrator profiles in industry managed to break down those barriers between office work and production work which are typical of old organizational strategies?).

Before pinpointing integrator archetypes in industry, it should be borne in mind that the most important software

involved includes:

- *Assisted operation of flexible and semi-flexible automatic systems (CAO - computer aided operations)*
- *Dynamic maintenance diagnosis of production resource breakdowns and malfunctions*
- *Control of strong and weak signals in respect of quality and process parameters (PPQC - product process quality control)*
- *Technical reliability of individual production resources (IA - inherent availability)*
- *Technical reliability of line systems (production of a finished product) (PLIA - production line inherent availability)*
- *Production flow operative control (PFOC)*
- *Horizontal process production smoothing (ICM - imaginary conveyor method)*
- *Main process smoothing system (MPSS)*
- *Main process identification (CPM - critical path method)*

***The goal of maximum productivity** of factors and **maximum quality** can be achieved through four functions having the following aims:*

1. *defining a network (industrial) in which all the main factors are interdependent and in which the practical solutions correspond to the simultaneous minimum value of total costs within external constraints;*

2. *formulating and using the operating resources to ensure that actual responses are in line with planning expectations at the level of individual processes;*

3. *converting the aims of each individual process into operating programs and implementing them in accordance with performance, resource efficiency and product quality commitments;*

4. *ensuring the efficiency of resources and the quality of operations though on-going improvement of assistance and prevention.*

These four objectives are achieved through the following four archetypes:

7.8.1 ***Automatic plant operator***
7.8.2 ***Integrated systems operator***
7.8.3 ***Process integrator***
7.8.4 ***System (network) integrator***

The following schedule:

Integrator profile responsibilities

	Automatic plant operator	*Integrated systems operator*	*Process integrator*	*System (network) integrator*
CPM				.....
MPSS				.....
ICM				.....
PLIA	----------	----------	.....	.....
IA			.....	
PFOC	----------	.....	.....	
PPQC	.....	.....		
DMD	.....	.....		
CAO	.....	.....		

shows how the areas of responsibility are linked to the four different integrator profiles in an increasing and continuous order from the automatic plant operator to the network integrator whose task is to formulate requirements.

Detailed specifications are annexed to this chapter showing:

- *the profiles*
- *the responsibilities / aims*
- *the task structure*

of these four archetypes.

ANNEXES TO CHAPTER VII

REFERENCE 7.4.3 *BASIC WORKING AREA: Direct interaction with customers*

ARCHETYPE: FRONT OFFICE INTEGRATOR

OCCUPATIONAL PROFILE

Workers who, on the basis of strategy guidelines and their own administrative, organizational and interpretative expertise/responsibilities/skills and with considerable autonomy and scope for problem-solving, interact directly with customers at the service counters of their institutions in order to build up an optimum relationship between customers and product planners/managers for whom they act as market indicators.

Their mastery of computer techniques, data processing skills for electronic data storage and consultation, document production and calculation and graphic skills allow them to approach a task logically in language appropriate to the customer's requirements so that these requirements can be processed by computer and a relevant range of choices can be directly offered at the counter allowing the customer to make the most appropriate and immediate selection of the product or service which best meets the requirements expressed.

They also set in motion any procedures needed to refer the customer to the chosen product specialist so that the

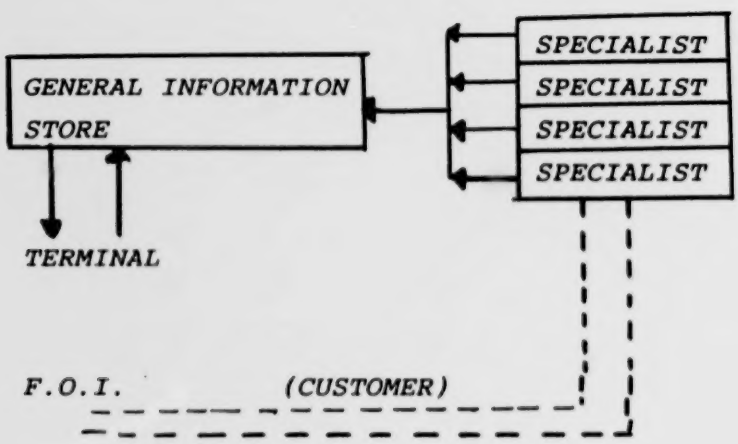
potential contract can be refined.

RESPONSIBILITIES AND AIMS

The front office integrator is a highly skilled worker responsible for guiding customers towards those products/services or packages of services which provide the most appropriate solution to their requirements and have the twofold aim of improving:

- *the content of the service offered (matching products to requirements);*
- *the quality of the service, by the rapid and selective management of demand allowed by the general ability to provide integrated responses (all front office integrators are interchangeable).*

DIAGRAM OF FRONT OFFICE INTEGRATOR ACTION



REFERENCE 7.4.4

BASIC WORKING AREA:
Synthesis unit

ARCHETYPE: BACK OFFICE INTEGRATOR

JOB PROFILE

Workers who, on the basis of management policy guidelines and their own administrative, organizational and interpretative expertise/responsibilities/skills and with considerable autonomy and scope for problem-solving, work out the general requirements for smoothing and balancing the network of products/services offered to customers, formulating strategic guidelines for the development of management policy through simulation models and methods such as "segmentation and competitive analysis".

Their interaction with top and middle management, specialists (product specialists) and lower-level integrators (front office integrators) allows them to locate, through their broad systemic view of the problems connected with business management (resources, manpower, structures, products), any synergies which already exist or which can be developed among different product lines and different functions, providing the basic back-up for synthesis unit activities.

They also develop and maintain the complex software (and/or expert systems) needed to back up their own work.

RESPONSIBILITIES AND AIMS

The back office integrator is a very highly skilled worker responsible for discovering the most appropriate methods for integrated business management so that product and task objectives can be harmonized so as to achieve the maximum possible synergy within a specific technological/market area.

REFERENCE 7.8.1

BASIC WORKING AREA:
Plant/new technology systems operation

ARCHETYPE: AUTOMATIC PLANT OPERATOR

JOB PROFILE

Workers who, on the basis of prescriptions and/or work cycles and/or designs and using the predetermined computer procedures, operate production machinery forming part of a computer aided automatic system, carrying out any measures, however complex, needed to start, set and adjust this machinery in order to achieve the required operating characteristics and performance levels.

They control product quality and system parameters using systems and models incorporated in the production process, possibly by introducing or varying technical process parameters; they take action, on the basis of the information supplied by the system, to locate any anomalies which the system may show and repair malfunctions of a irregular and random nature requiring action of a conventional level of difficulty.

RESPONSIBILITIES AND AIMS

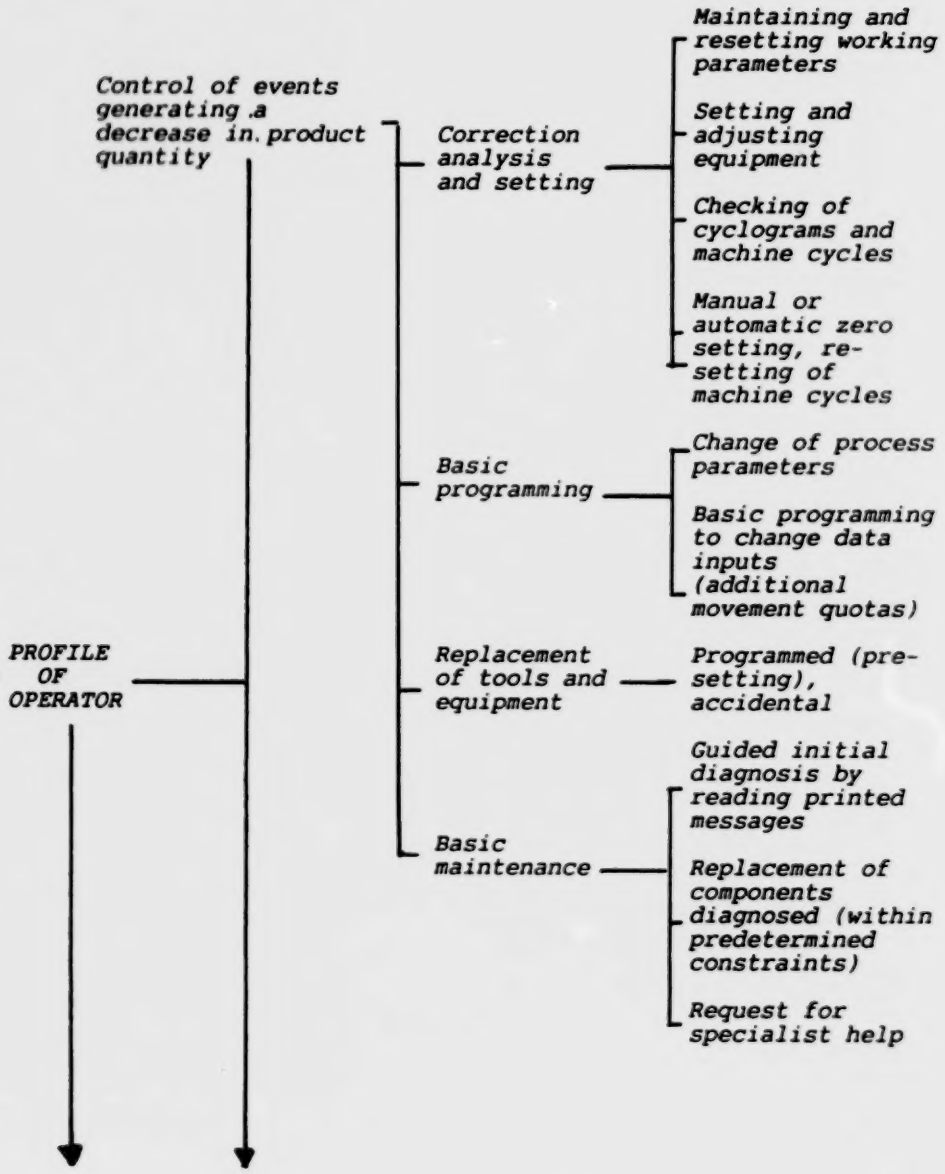
PROCEDURAL OPERATION OF MECHANICAL SYSTEMS

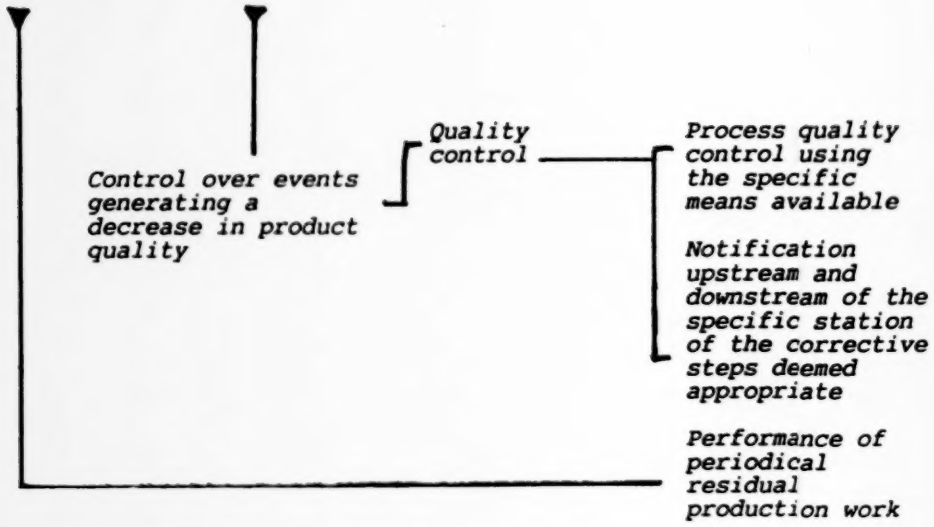
The procedural mechanical systems operator is a skilled

worker responsible for optimizing the local efficiency of resources and the quality of the operations assigned to him, while observing and achieving predetermined rules.

He can interact directly with the higher level of integration through teamwork when part of a complex working system with several interdependent work stations.

AUTOMATIC PLANT OPERATOR - TASK STRUCTURE


PROFILE OF OPERATOR
Control of events generating a decrease in product quantity
Correction analysis and setting
Maintaining and resetting working parameters
Setting and adjusting equipment
Checking of cyclograms and machine cycles
Manual or automatic zero setting, re-setting of machine cycles
Basic programming
Change of process parameters
Basic programming to change data inputs (additional movement quotas)
Replacement of tools and equipment
Programmed (pre-setting), accidental
Basic maintenance
Guided initial diagnosis by reading printed messages
Replacement of components diagnosed (within predetermined constraints)
Request for specialist help


Control over events generating a decrease in product quality
Quality control
Process quality control using the specific means available
Notification upstream and downstream of the specific station of the corrective steps deemed appropriate
Performance of periodical residual production work

REFERENCE 7.8.2

BASIC WORKING AREA:
Plant/new technology systems operation

ARCHETYPE: INTEGRATED SYSTEMS OPERATOR

OCCUPATIONAL PROFILE

Workers who, on the basis of prescriptions and/or work cycles and/or designs and using the predetermined computer procedures, operate production machinery forming part of a computer aided automatic system, carrying out any measures, however complex, needed to start, set and adjust this machinery in order to achieve the required operating characteristics and performance levels.

They control product quality and system parameters using systems and models incorporated in the production process, possibly by introducing or varying technical process parameters; they take action, on the basis of the information supplied by the system, to locate any anomalies which the system may show and repair malfunctions of a irregular and random nature requiring action of a conventional level of difficulty.

They also manage and operate programs for smoothing production and monitoring actual flows, introducing independently formulated and decided variables which are needed to remove variants occurring during disturbances.

RESPONSIBILITIES AND AIMS

PROCEDURAL OPERATION OF INTEGRATED SYSTEMS

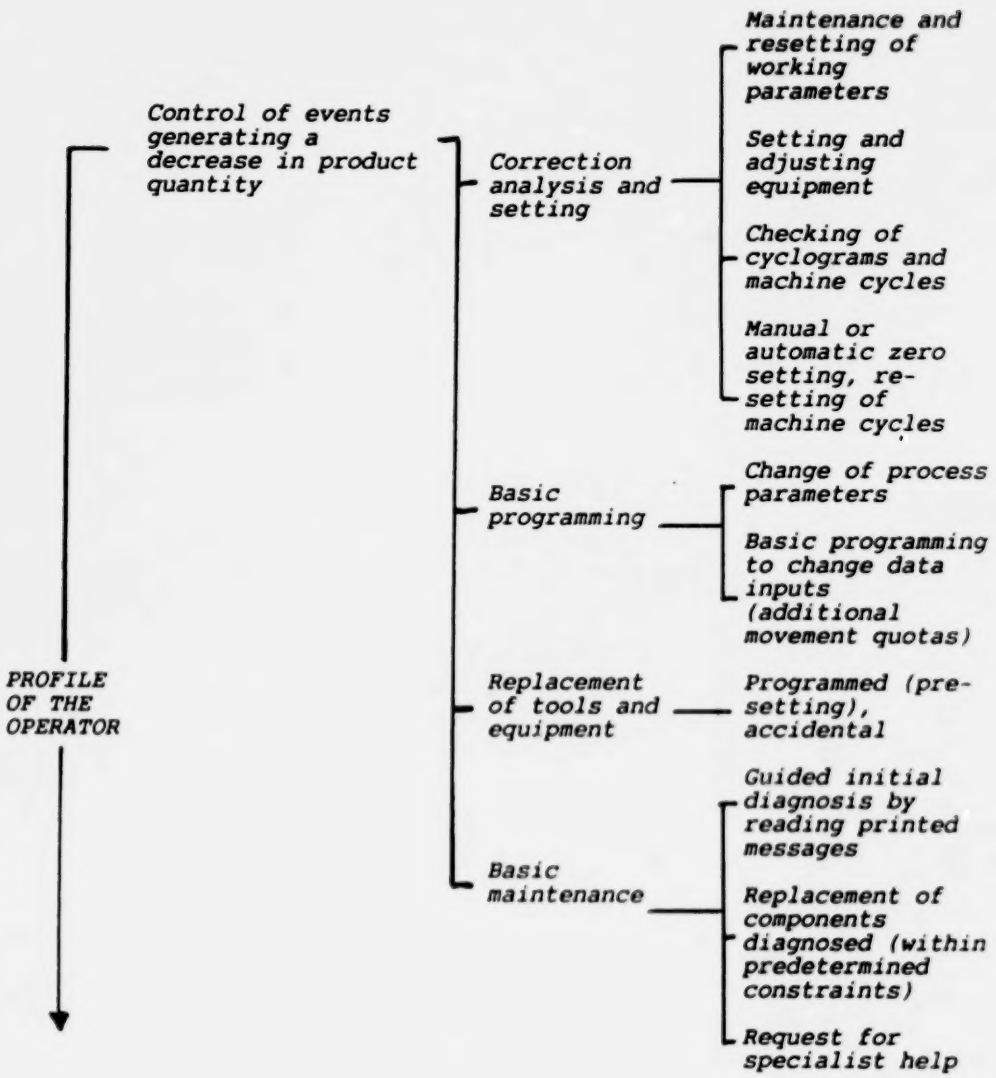
The procedural operator of mechanical systems is responsible for optimizing the local efficiency of resources and the quality of the operations assigned to him, while observing and achieving predetermined rules.

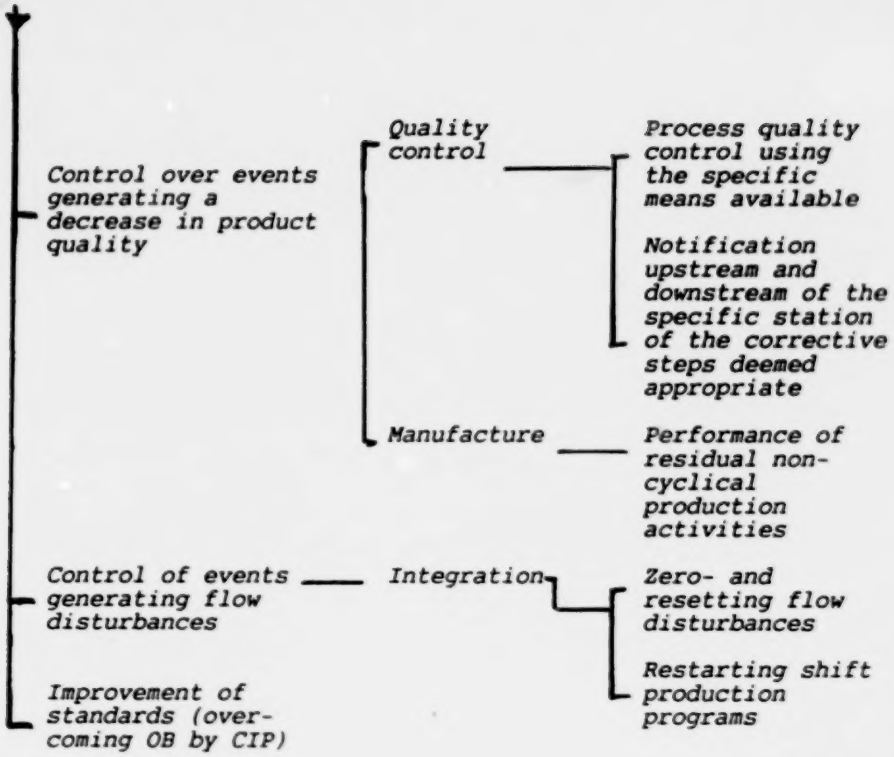
He can interact directly with the higher level of integration through teamwork.

His basic responsibilities also include:

- *optimizing and smoothing actual production flows by zero setting variants and restarting programs.*

INTEGRATED SYSTEMS OPERATOR - TASK STRUCTURE


PROFILE OF THE OPERATOR
Control of events generating a decrease in product quantity
Correction analysis and setting
Maintenance and resetting of working parameters
Setting and adjusting equipment
Checking of cyclograms and machine cycles
Manual or automatic zero setting, re-setting of machine cycles
Basic programming
Change of process parameters
Basic programming to change data inputs (additional movement quotas)
Replacement of tools and equipment
Programmed (pre-setting), accidental
Basic maintenance
Guided initial diagnosis by reading printed messages
Replacement of components diagnosed (within predetermined constraints)
Request for specialist help


Control over events generating a decrease in product quality
Quality control
Process quality control using the specific means available
Notification upstream and downstream of the specific station of the corrective steps deemed appropriate
Manufacture
Performance of residual non-cyclical production activities
Control of events generating flow disturbances
Integration
Zero- and resetting flow disturbances
Restarting shift production programs
Improvement of standards (over-coming OB by CIP)

REFERENCE 7.8.3

BASIC WORKING AREA:
Process integration

ARCHETYPE: PROCESS INTEGRATOR

OCCUPATIONAL PROFILE

Workers who, on the basis of strategy guidelines and their own managerial, organizational and integration expertise/responsibilities and skills and with considerable autonomy and scope for problem-solving, operate overall processes constituted by computer-aided automatic systems, pinpointing the order of priority of technological adjustment and setting operations so as to ensure an optimum result from the point of view of quality and performance.

Their interaction with specialists from engineering departments and with systems operators allows them to formulate the reliability parameters of the component systems and the equivalent reliability of the process, as well as synergy diagrams and dynamic prevention plans.

They develop and update software for the technical smoothing of the processes in relation to any layout modifications which are made either at their own initiative or as a result of inputs from other areas (technology, hierarchical functions, etc.).

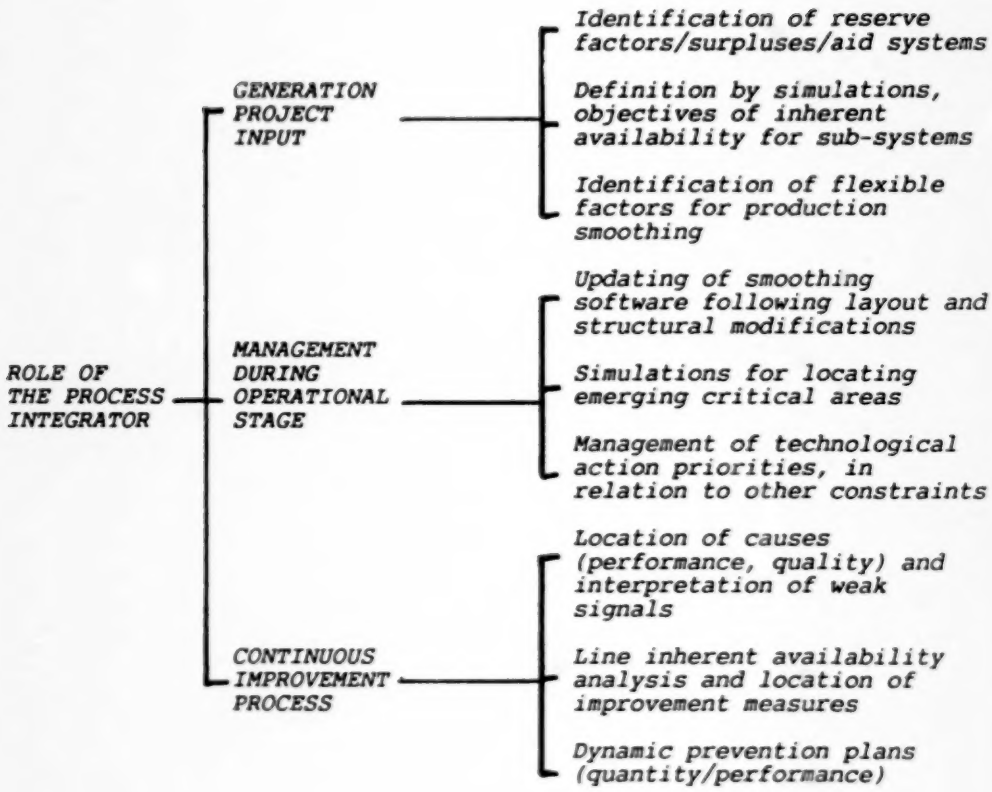
At the planning stage, they formulate general performance objectives and the optimum architecture of the process in terms of part objectives.

They shape and coordinate the continuous improvement process from the point of view of technological performance, where necessary developing and implementing any interactions needed with the other components of the organization.

RESPONSIBILITIES AND AIMS

The process integrator is a highly skilled worker responsible for optimizing the efficiency and overall quality of a process as a whole, while respecting constraints and strategy guidelines deriving from compatibility with other objectives.

PROCESS INTEGRATOR - TASK STRUCTURE


ROLE OF THE PROCESS INTEGRATOR
GENERATION PROJECT INPUT
Identification of reserve factors/surpluses/aid systems
Definition by simulations, objectives of inherent availability for sub-systems
Identification of flexible factors for production smoothing
MANAGEMENT DURING OPERATIONAL STAGE
Updating of smoothing software following layout and structural modifications
Simulations for locating emerging critical areas
Management of technological action priorities, in relation to other constraints
CONTINUOUS IMPROVEMENT PROCESS
Location of causes (performance, quality) and interpretation of weak signals
Line inherent availability analysis and location of improvement measures
Dynamic prevention plans (quantity/performance)

REFERENCE 7.8.4

BASIC WORKING AREA:
Network integration

ARCHETYPE: NETWORK INTEGRATOR

OCCUPATIONAL PROFILE

Workers who, on the basis of strategy guidelines and their own managerial, organizational and integration expertise/responsibilities and skills and with considerable autonomy and scope for problem-solving, formulate the general conditions for smoothing a highly integrated industrial network, defining strategic purchasing guidelines and implementing the process network through simulation models.

Their interaction with top and middle management and with specialists and lower-level integrators (process integrators) allows them to formulate specifications prescribing the features of the individual processes making up the network, paying particular attention to prescriptions relating to the hourly production potentials of production resources, the features of the flow of materials (stock in process fluctuation) and labour organization.

They also develop and update overall software (and/or expert systems) for smoothing networks, through research into the optimum balance between economic components

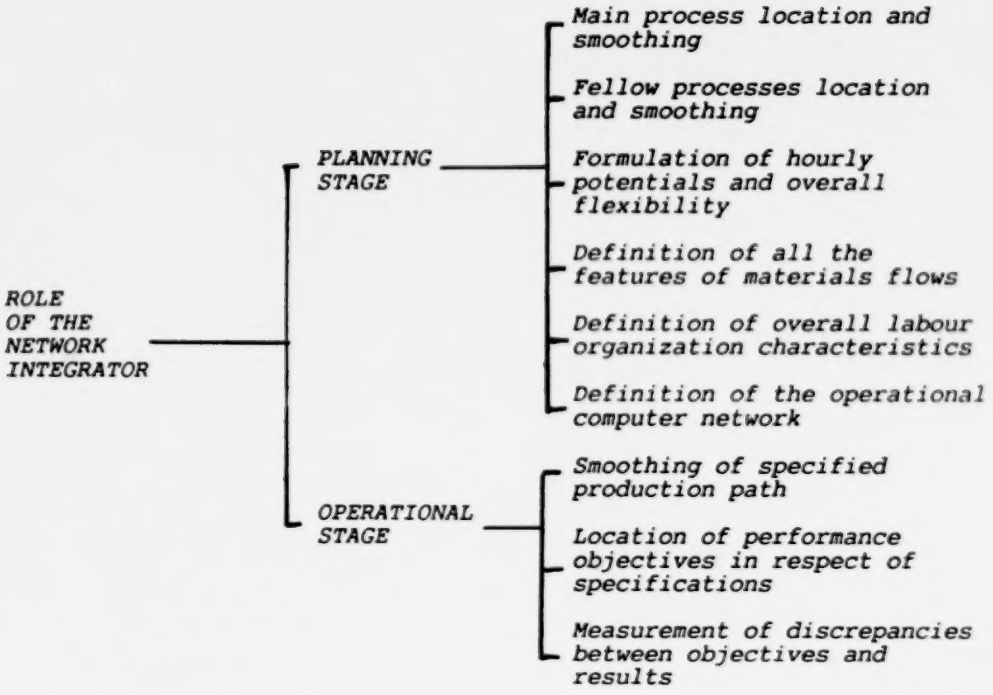
(econometric models) and technological and regulatory components (labour regulations).

At the operational stage, they formulate the objectives to be achieved on the basis of the actual approaches implemented, measuring performance and overall discrepancies from the point of view of incentives and participation.

RESPONSIBILITIES AND AIMS

The network integrator is a very highly skilled worker responsible for optimizing an integrated industrial network, smoothing the various sectors while observing technological and regulatory constraints and balancing them harmoniously with structural components so that regulation can be of the self-adjusting type.

NETWORK INTEGRATOR - TASK STRUCTURE


ROLE OF THE NETWORK INTEGRATOR
PLANNING STAGE
Main process location and smoothing
Fellow processes location and smoothing
Formulation of hourly potentials and overall flexibility
Definition of all the features of materials flows
Definition of overall labour organization characteristics
Definition of the operational computer network
OPERATIONAL STAGE
Smoothing of specified production path
Location of performance objectives in respect of specifications
Measurement of discrepancies between objectives and results

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Description of a framework of macroprofiles (archetypes)

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